THE

ELECTRICAL REVIEW.

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ELECTRICAL REVIEW.

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THE

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(J. A. BERLY'S).

1908 EDITION

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TRADE UNIONISM OR CHAOS?

THE recent strike in the shipbuilding trade, now brought to a happy conclusion, is well calculated to fill the mind of the employer with uneasiness. So far as the inception of the struggle is concerned, there was nothing out of the common. It arose out of a dispute as to wages; and if all is well that ends well, the fact that the masters gained the day in the end ought to be reassuring. But the serious matter to consider was the attitude adopted by the men during the struggle. They threw over, and refused to be bound by, their acknowledged leaders. What is there to prevent the employés in any other trade taking the same course on a future occasion? If the practice became universal, we should step from trade unionism to chaos. While much has been said and written of the tyranny of trade unions, employers have always recognised the advantage of being able to negotiate with the responsible head of an organisation of workmen. The secretary of a union is usually a man of greater intellectual power than the ordinary members; and if he happens to be a member of Parliament, or is otherwise engaged in public affairs, he is generally able to take a broad view of the questions at issue between his members and their employers. We well remember that Sir Thomas Wrightson, when speaking on the Trades Disputes Bill in the House of Commons, laid emphasis on the cordial relations which had always existed between him and the representatives of the men's unions. His views are doubtless shared by other large employers of labour.

If it was in the interest of the men to give plenary powers to their representatives in former days, it is doubly in their interest to do so at the present time. There are many forces at work to reduce wages, and it would be impossible for the average workman to be cognisant of them all. The act of the employer in reducing pay all round may be due to increased cost of production, or to other reasons over which he has little or no control. One need only mention the Factory Acts, the Employer's Liability Act, and the Workmen's Compensation Act, to remind the reader of the way in which the Legislature, in its wisdom, has hampered employers in recent years. A trade union official—or even the responsible committee of a union—may understand these matters, and be able to impress the more reasonable amongst the men with the master's point of view. But what is to happen if the men renounce their secretary and overrule the authority of the committee? *Quot homines, tot sententiæ!* The chance of reconciliation with the employers, always remote, disappears altogether; a long and bitter struggle, which can only end in ignominious surrender, is the inevitable result.

It may be urged, in answer to this, that the men will not, as a rule, refuse to acknowledge their leaders. That may be so in many cases. The older workmen, who have much

to lose and little to gain by disruption with their employers, may listen to reason. But it is otherwise with the younger men. They have little to lose and—from a very narrow point of view—much to gain by idleness. They get some immediate benefit from the union funds, and are not old enough to realise that those funds ought properly to be devoted to the sick and aged. With men of this stamp the employer can never hope to argue; and if they ever get the upper hand it will be a sorry day for the British industrial community.

We are inclined to think, however, that there are tendencies at work which will ultimately prevent even the most restive of the younger workmen rushing headlong into warfare with the employer. There is the Trades Disputes Act. When this measure was placed upon the statute book members of the men's trade unions throughout the country received it with pæans of joy. This was to be the charter of their liberties! This was to prevent employers interfering with the conduct of a strike; was to protect the unions from the consequences of unlawful acts. It was noticed at the time, and we commented upon the fact in these columns, that employers remained strangely silent while this Bill was under discussion. No doubt protests were made on their behalf in Parliament, but nothing in the nature of an agitation occurred. Why? The reason is now becoming apparent. The Act conferred equal rights on masters and men. It made master and man immune. The masters did not demand either sword or shield, but they accepted them in self-protection, and the men are now beginning to find that the employers' unions are stronger than before.

Steam Heating from Central Stations.

As a source of revenue to an electricity works, there is something to be said for supplying steam for heating to contignous premises. In the *Central Station* the subject is dealt with by Mr. J. A. White, who states that the underground transmission of steam has been in continuous and successful operation for 31 years, yet is but little known to, or appreciated by, central-station operators and engineers. Yet the system has many conveniences—not the least being freedom from the dirt of the usual furnace in a house, a perfect service with greater economy, reduced fire risk, gain of storage space, and, it might be added, reduced labour. At the Vine Street power station in Johnstown, Pa., there are engines collectively of 1,800 H.P, supplied by boilers of nominally 1,750 H.P., with mechanical stokers, fuel economisers and other feed-water heaters. Another station in Broad Street, with 1,200 H.P. of boiler rating, is connected to the same steam distributing system. A 14-in. and a 10-in. steam main take steam from the Vine Street exhaust piping. These mains have a length underground of 13,340 ft., exclusive of service pipes. They supply steam to 294 business blocks, residences and public buildings, containing 15½ million cb. ft. of space. Each foot of main underground supplies an average space of 1,159 cb. ft. All customers receive an ample supply of steam, with a back pressure on the engines of only 2 to 5 lb. During the colder parts of the year live steam is automatically delivered through reducing valves to supplement the exhaust supply. The mains are of wrought-iron, wrapped in asbestos paper wound with copper wire, and there is also an inch of air space between the pipe and the wooden insulating casing in which the pipe is centred; the pipe is carried on rollers to allow of its free movement. The wood casing is 4 in. thick, made up of kiln-dried white pine staves, tongued and grooved, and lined inside with bright tin. The exterior is tightly wound with heavy galvanised wire, and the whole is rendered externally with asphaltum and sawdust. Seepage water is carefully drained away, three-ply tar paper being laid on the top of the casing and tile drains below the casing in trenches filled with broken stone.

The result is that condensation in the street mains does not exceed 5 per cent. of the total season's output—a fact that is commended to gas and electrical transmission men for study.

An expansion device is placed every 100 ft. It consists of a corrugated copper disk held in a frame anchored in a brick box, the latter being filled with pine shavings. Service pipes branch out on the top side of the anchorage fittings, and wood casing is used for these pipes also. Flanged fittings are left at cross streets for extensions where justified, and valves are placed at suitable points, so as to make it possible to make new connections with a minimum of inconvenience to existing customers. In 26 months of work the KW.-hours of the station were 6,856,950, and of this quantity 5,252,347 were produced in 18 months. The total cost of fuel, water and boiler-house labour in the 26 months was about £10,428, and the cost during the 18 heating months £8,200. In the 26 months the income from steam sold was £12,600, and in 18 heating months it was £12,140. Thus the income from steam exceeded the expense of producing it, and therefore the cost of steam to the engines was less than nil by some £4,000 during the 18 months' period. The steam, in fact, produced £4,000 and 5¼ million KW.-hours of electrical energy. Steam is sold by weight on a meter basis, the condensation water in each building being collected and passed through a trap and a heating coil, and through a Simplex condensation weighing meter. The steam per KW.-hour needed during the 18 heating months was only 20 per cent. greater than that required during the non-heating months.

The conclusion is drawn that it is an economic error to place stations away from thickly-built-up areas merely to save land charges or to get condensation water; also that the supposed economy of the gas engine *per se* does not exist. This is all very well to argue, but when will it be possible so to teach our municipal authorities that they will perceive that such things are possible?

The Purchase of a Tramway Undertaking.

TRAMWAY companies whose property is likely to be taken over by a local authority must not assume that, when the purchase price is being assessed, they will get full value for their entire undertaking. There are certain words of limitation in the purchase section of the Tramways Act, 1870, which the courts are inclined to construe very strictly. Such a thing, for instance, as a car factory may be property which the local authority is not bound to take over. Numerous difficult questions arose at one time, when the purchase of the old horse-tramway systems was under discussion. Local authorities which decided to adopt electric traction were naturally anxious to buy as little obsolete plant as possible. Recently, however, there have been few cases on the subject. The latest is a decision of the Court of Appeal relating to the purchase of a portion of tramway leading from the street rails to a car factory. We refer to North Metropolitan Tramways Co., Ltd., *v.* Leyton Urban District Council, which was noted some time ago in the ELECTRICAL REVIEW. It appeared that a tramway of the plaintiffs, authorised by an Act passed in 1870, ran for some distance over private land, and for at least 62 ft. penetrated within the entrance gates of a large car factory erected on their land by the company, and for at least 4 ft. 8 in. under the roof and within the walls of the car factory. On the purchase by the Council from the company of this and other tramways, and "all lands, buildings, works, materials and plant of the company suitable to and

used by them for the purposes of their undertaking within such district," an arbitrator found that the car factory was not suitable to and used by the company for the purposes of their undertaking within the district, and he awarded and determined the value of the portion of the permanent way of tramway No. 13, which was upon the private land, including the entrance gates, but not including the value of any buildings, to be the sum of £125. It was held that, the arbitrator having found that the car factory was not suitable to and used for the purposes of the company's undertaking within the district, the fact that the authorised tramway which was being purchased extended for 62 ft. within the gates of such factory did not render the Council liable to purchase either the factory or the land on which such 62 ft. of tramway was laid. Lord Justice Farwell observed that the notice to purchase the tramway only extended to the tramway up to the boundary of the car factory, and that the part of the tramway within the boundary was included in that part of the notice to purchase which referred to "lands, buildings . . . suitable to and used for the purposes of the undertaking within the district," and that, therefore, as the arbitrator had found that the Council was not bound to purchase the car factory, it was not bound to purchase the 62 ft. of tramway within it.

Single-Phase Traction.

The completion of the first single-phase electric railway in this country—that of the Midland Railway Co., between Lancaster and Heysham Harbour—is an event of considerable interest. Although the first railway operated with electric traction was constructed in England, and has been followed by many others, we have undoubtedly fallen behind in the march of progress; enormous advances have been made in the adoption of the single-phase principle, both on the Continent and in America, while we have maintained a waiting policy. Yet there is probably no country in the world where the conditions are more favourable to the conversion of the railways to electrical traction, in view of the density of traffic, the congestion of termini, and the need of rapid transit between city and suburbs.

We commence, elsewhere in this issue, an illustrated description of the Midland Railway experimental section, which is now open for public traffic. Good progress is being made with the equipment of the London, Brighton and South Coast Railway Co.'s electrical section between Victoria and London Bridge, and we trust that with these two examples in successful operation, our railway engineers and managers will realise that the time is ripe for the wholesale conversion of their suburban systems to modern methods of operation. It is to be hoped, also, that every effort will be made to secure uniformity of system as far as possible from the commencement, so that when the various lines are eventually linked up, no difficulty will be experienced in exchange of traffic.

Electrobuses for Eastbourne.—In the course of a discussion at Eastbourne recently, a Councillor moved as an amendment that if the Motor-'Bus Committee could arrange satisfactory terms for the sale of the four single-decked cars and for the hire of suitable batteries, the Committee should be authorised to purchase four Electrobuses and acquire such plant as might be necessary for the supply of electric power from the Corporation Electricity Works at prices not exceeding the estimates of the borough accountant. The amendment was rejected, but eight members voted for it.

British Electrical Manufacturers too Busy—or What?—In a recent issue of the *Mining Journal*, the Launceston, Tasmania, correspondent of that journal, says:—"Considerable progress is being made in utilising water-power, combined with electricity. At the Magnet, the North Farrell, the Mount Bischoff, the Pioneer, and others, plants are either erected or in course of erection." The writer adds:—"Inspection of these plants gives rise to the question whether any electric machinery is now made in England. The American or German makers seem to hold the field. In view especially of future possibilities, this seems regrettable."

EXPERIMENTS ON A HIGH-FREQUENCY CARBON ARC.

In a recent article in the *Elektrotechnische Zeitschrift*, Dr. Sahulka describes some experiments on an arc struck between solid carbons inserted in the high-frequency circuit of a direct-current Duddell-Poulsen arc. The arrangement used is shown in fig. 1. The direct-current supply was a 220-volt one, taken from one side of a three-wire supply, through a resistance W of 38 ohms and a choking coil D. The Duddell arc G was formed horizontally in a coal gas flame between a 7-mm. solid carbon K and an 11-mm. copper tube Cu, through which cooling water was passed. The copper tube was the positive terminal. The arc was hand regulated. The high-frequency circuit contained (1) the condenser C, made up of Leyden jars with a total capacity of ·1467 microfarad; (2) the inductive resistance S, consisting of the primary of a Tesla coil having 12 turns 20 cm. in diameter, two solenoids of 100 turns each of thick wire with a diameter of 3·5 cm., and an additional coil of 21 turns of covered wire wound on a 15-cm. diameter; and (3) the arc L formed between two short pieces (2 cm. each) of 5-mm. diameter solid carbon arranged

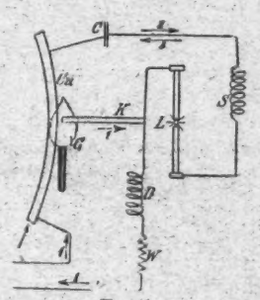


Fig. 1.

vertically. As soon as the carbons L were separated (by hand gear) an arc with a pleasant white light was formed, and by suitably arranging the length of the arc G, the high-frequency arc L could be made as much as 10 mm. long. The lower the self-induction used, the greater was the difficulty in forming the arc L, and in the following experiments the above self-induction was maintained constant. Measurements were made of the following quantities: i_1 the current in the direct-current circuit (by means of a moving-coil instrument), e_1 the direct-current voltage across the arc G (by a moving-coil instrument), e the total voltage across G, made up of e_1 and the superposed high-frequency voltage e_2 (by means of a hot-wire voltmeter, previously compared with an electrostatic voltmeter on the high-frequency supply and found correct), i_2 the current in the high-frequency circuit (by hot-wire meter), ε the resultant pressure across the condenser C (by electrostatic voltmeter), and Δ the voltage across the high-frequency arc (by hot-wire meter).

As soon as a reading had been taken (keeping the voltage across the high-frequency arc constant by hand regulation) the direct-current circuit was quickly broken, and the length l of the high-frequency arc was measured. Readings were taken with various values of l from 9·5 mm. to ·3 mm., as shown below.

The length of the direct-current arc was not specially controlled, and it varied in the different readings.

With the high-frequency circuit open the direct-current arc took about 5 amperes at about 40 volts. As soon as the high-frequency current flowed, the direct current fell considerably, whilst the direct-current voltage across the arc G rose, owing to the fact that the superposed high-frequency current increases the resistance of the arc more during the half cycles when it is opposing the arc current than it reduces the resistance during the intermediate half cycles.

The value of the high-frequency voltage e_2 is calculated from the equation $e = \sqrt{e_1^2 + e_2^2}$. The measured voltage ε across the condenser is made up of the direct-current voltage e_1 and the alternating voltage ε_2 due to the high-frequency current, so that from the equation $\varepsilon = \sqrt{e_1^2 + \varepsilon_2^2}$

the value of e_2 can be obtained, and then the frequency f in the high-frequency circuit is arrived at from the fact that $i_2 = e_2 \times 2\pi \times f \times C$. The last column gives the resistance W of the high-frequency arc, which is the quotient of Δ and i_2.

Experiment No.	Measured values.							Calculated quantities.			
	i_1	e_1	e	i_2	ϵ	Δ	l	e_2	ϵ_2	f	W
1	5	40	40	—	—	—	—	—	—	—	—
2	3·2	102	130	4·0	200	40	9·5	80·6	172	25,230	10·0
3	3·5	92	135	4·1	200	35	6·0	98·1	177·6	25,050	8·5
4	3·4	92	155	4·6	230	30	4·0	124·7	210·8	23,670	6·5
5	4	76	110	4·2	195	25	2·0	79·5	179·6	25,140	5·9
6	4·1	70	102·5	4·4	202	20	1·2	74·9	189·2	25,230	4·5
7	4	63	105	4·5	205	15	·3	84·0	195·1	25,020	3·3

It will be seen that it was possible to maintain short arcs with as little as 15 volts (in some cases 14 volts), which would indicate that the high-frequency current has a much more peaked curve than a sine wave.

The fact that the effective alternating voltage e_2 across the direct-current arc G exceeds the direct-current voltage e_1 (in all cases except No. 2), whilst the maximum values of e_2 must be still more in excess, indicates that the current in G does not simply pulsate, but actually alternates.

The constancy of the frequency shows that the resistance in the high-frequency circuit has very little effect on the frequency (W varied from 3·3 to 10, and the resistance of the direct-current arc G also varied somewhat, whilst f remained at approximately 25,000).

ELECTRICITY OR GAS?—THE PROBLEM OF THE SMALL CONSUMER.

By JOHN D. MACKENZIE.

The once-famous expression, "the poor man's light," as applied to electricity, somehow of late has been quietly dropped by the electrical fraternity. Whether we are too busy installing the said light and supplying the necessary energy for it, or whether we are simply keeping a judicious silence in face of the gas world's aggression, it is not the writer's present intention to inquire. He has ventured to bring forward the subject at this juncture believing that it is quite ripe for discussion, and that electricity can now easily live up to the title conferred upon it years ago.

When the electrical engineer could pick and choose his clients, the small consumer was quietly ignored, but, with the present keen competition between rival illuminants, such a policy simply will not pay, and it is for us now to face the problem—for problem it certainly is—of cheaply installing and cheaply supplying the demands of the small—I had almost said the ultra-small—consumer.

In all our large cities and in very many small ones are tens of thousands who require a maximum installation of from three to ten lamps with a maximum demand of from one to five lamps at any time, and although the individual consumption may be very small, still, if multiplied by tens of thousands, it may make a world of difference to a central-station balance-sheet. Besides, these small consumers are to a great extent closely grouped together, making the provision of supply a comparatively easy matter.

For example, within the bounds of a certain municipal area, known to the writer, there are the following dwelling houses :—

(1) Of two apartments	81,734
(2) Of three ,, ...	32,366
(3) Of four ,, ...	13,228
(5) Of five and upwards	14,648
	141,976

Other cities can probably show a somewhat similar state of matters, and although it is far from the writer's intention to suggest that all this field can be gained for electric lighting, yet he sees no adequate reason why an attempt should not be made to oust gas out of all the new buildings of all the foregoing classes and to substitute electricity therefor.

The objections usually urged against the use of electricity for the small consumer are two-fold :—(*a*) The cost of installation is too high ; (*b*) The cost of using is too high.

In plain language, it is asserted both by friend and opponent that for this class of work electricity is too expensive to install and to use. Indeed, a paper recently read before the Institution dismisses the small consumer most contemptuously, and the authors assert that it is practically impossible to supply such consumers with electricity except at a prohibitive price. It is quite bad enough to hear this from our rivals, but to have it told us by our friends is out of the question.

As regards the latter, various tests go to show that with metallic-filament lamps the objection is not well founded, and some recent tests shown to the writer, and referred to later on, go to confirm this. It is to be regretted that the metallic-filament lamps are so high in first cost, but doubtless the keen competition between rival makers will soon make itself felt and cause the prices to come down very considerably. Another objection to the metallic-filament lamp, especially in high voltages, is its extreme fragility. Here, again, improvements will be made—indeed, are being made—which will help to extend its usefulness. As, however, these objections diminish or disappear at the voltages proposed by the writer, they do not affect his present purpose.

Cost of Installation.—Regarding cost of installation, however, the writer must admit that the objection at present is quite valid. It certainly is cheaper to install gas than electric light, with present systems and under present conditions.

Everyone admits that part of the question ; there is so much expense added to installations in order to fulfil rules, many of them quite unnecessary and even frivolous. But is it hopeless to suggest the possibility of altering this state of matters ; is there any sufficient reason why some simpler method should not be adopted, why some relaxation of rules and regulations should not be given, and why consideration of the subject should be so lightly brushed aside?

The cost of installation has a good deal to do with the price at which energy can be economically supplied, and hence it must be gone into carefully. The total cost is made up of two principal parts, namely :—

1. Cost to the supply company of giving a supply.
2. Cost to the proprietor of installing the necessary wiring and fittings.

Cost to Supply Company.—This, of course, varies with circumstances, and may be great or small. Hence it is impossible to give a figure that would suit all cases, but those given may be taken as fair average values, and any alterations necessary to fit local conditions may easily be made. It must of necessity be cheaper to lay down a length of iron gas pipe than an equivalent length of well insulated and protected copper cable, and it is not the writer's intention to suggest that an electric supply company can compete with its gas rival in this respect. At the same time, no doubt if the supply company saw its way to pay interest and depreciation, &c., on its mains and make a profit on the sale of energy at the same time, this difference would not be allowed to bar further progress.

Of course, where a supply is given by means of overhead mains, it is quite within the limits of possibility for a supply company to beat the gas even in this respect, and the author sees no reason why overhead mains fed by one or two branches from the underground mains should not be used to supply groups of houses.

The question of supply mains is not, however, of so much importance as it might at first sight appear to be. The writer's experience has led him to believe that in the majority of cases, the supply cables are practically passing the poor man's door, very often supplying only a motor day-load, and with little or no demand at night. In these cases all that is required, at most, is an extension of a few yards of distributor cable, some lengths of service mains, and several joint boxes.

This part of the problem can safely be left in the hands

of every live central-station engineer, with the assured conviction that he will not let an opportunity of adding to his revenue slip past him.

Meters.—A more debatable point, however, is the provision of a meter. It is obviously unprofitable to install a meter costing several pounds to register a demand amounting to a few shillings annually, and there is a large field awaiting the advent of a reliable and accurate meter not easily deranged, and costing something under, say, 20s. for a five-ampere load. The writer is aware of the existence of low-priced electrolytic meters, but in many quarters there exists a decided prejudice against their use. Whether this is, or is not, well founded, the writer would leave to be decided by the opinions of central-station engineers who are more competent to judge these matters than he is. No doubt the makers of such meters will also be quite ready to defend their manufactures, and to inform us whether or not they have successfully overcome the difficulties which undoubtedly attend the construction of such instruments.

As far as the writer's present object is concerned, all electrolytic meters must be put of court, as he is unaware of any which can be utilised on alternating-current circuits.

Cost of Supplying Electrical Energy.—Having thus far dealt with the general conditions of supply, it is necessary now to make some calculations dealing with average costs, and to find from such consideration the minimum prices at which a supply can profitably be given to small consumers. Assuming an installation of from two to three lamps, each using, say, 25-volt 16-c.p. Osram lamps, consuming, say, 20 watts per lamp, if it can be shown that such a very small consumer can be very profitably supplied with electricity, it will surely be unnecessary to labour the point in the case of any larger demand.

In houses of the class assumed it is quite safe to reckon a minimum use of 2,400 lamp-hours, which at 20 watts per lamp gives an annual demand of 48 units, with a maximum demand at any one time of ·042 KW*. In order to give this supply, the central-station engineer must install generating machinery, distributing mains, and meter.

The following table gives estimated costs and relative charges for these items :—

TABLE I.

	Per KW.	Per individual demand.	Depreciation, interest, sinking fund, &c.	Cost per unit, 48 units.
Generating machinery ...	£25	£1·05	2·1s.	·525d.
Mains and distribution...	20	·84	1·68s.	·42d.
Meter	—	1·5	3s.	·75d.
Generating costs, say ...	—	—	—	·9d.
Price per unit exclusive of profit...				2·595d.

This would indicate, on a first calculation, that 3d. per unit should pay very well for such consumers; the distribution scheme propounded later, however, may modify this somewhat.

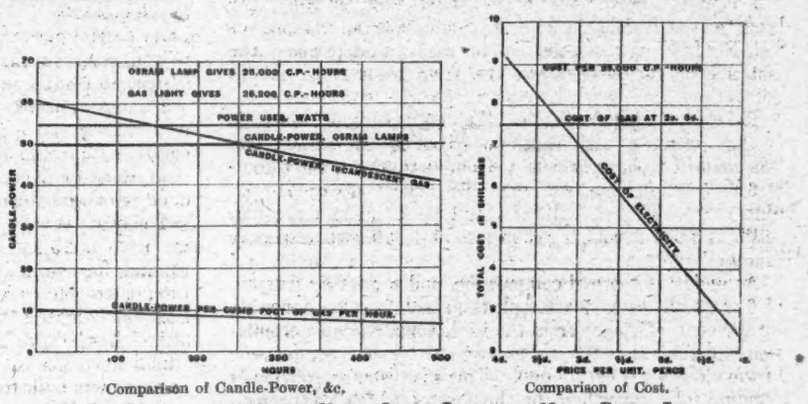
Comparative Burning Costs of Gas and Electricity.—This is a vexed question, and no amount of theoretical calculations can settle it. At the same time even the gas engineers admit that the metallic-filament lamp is a competitor of no mean order.

Some recent comparative tests in a public institution—the writer regrets that he has not authority to publish these *in extenso*—are of distinct value in coming to a decision. In the installation referred to, all incandescent gas fittings were replaced by an equivalent number of metallic-filament lamps, and all flat-flame burners were replaced by equivalent carbon filament lamps.

Neglecting the value of the increased lighting so obtained—and it was certainly not a negligible quantity by any means—the costs for similar periods under identical conditions were 71 : 100 in favour of electric lighting, the cost of gas being 2s. 8d. per 1,000 cb. ft., and of electricity 3d. per unit.

Taking this result, which was carefully obtained, as a very accurate approximation to every-day results, we find that it is possible to equate electricity and gas as under :—

Electricity per unit.		Gas per 1,000 cb. ft.
3d.	is equivalent to	1s. 10½d.
3·5d.	„ „	2s. 2½d.
4d.	„ „	2s. 6d.
4·5d.	„ „	2s. 9¾d.
5d.	„ „	3s. 1½d.



Comparison of Candle-Power, &c. Comparison of Cost.

FIG. 1.—COMPARISON BETWEEN 50-C.P. OSRAM LAMP AND 65-C.P. BLOCK LIGHT XX MANTLE ON BLOCK LIGHT BURNER ON 500 HOURS' BURNING.

That these figures are not unduly favourable to electricity is evident on examining the result of a recent comparative test between Block light mantles and Osram lamps, in which the figures work out as 3·25d. per unit for electricity, and 2s. 6d. per 1,000 cb. ft. of gas on an equivalent candle-power-hour basis (fig. 1).

While the writer is unwilling to put forward any of the foregoing figures as absolutely authoritative, a consideration of them must convince any unbiased person that on the score of burning costs electricity can compete on at least equal terms with gas; while the numerous advantages it possesses in the direction of cleanliness and handiness, place it far above gas.

Scheme of Distribution.—In proposing the following scheme, the writer is aware that he is suggesting nothing very novel, but he has endeavoured to bring it into the region of practical discussion by putting the cost of the installation into figures. He hopes that the discussion which may result from these remarks will add materially to our knowledge and pave the way to some relaxation of installation rules.

It is, of course, as previously indicated, impracticable to give a separate service main to each ultra-small consumer, but such consumers are generally to be found in flats either in large or small tenement buildings, and it is quite convenient to arrange one service main to supply from four to eight consumers. That is being done in hundreds of instances at the present time, but in all these cases the full supply voltage is distributed to each consumer, and hence the interior wiring and fittings must be of such a nature as to be safe for use with the working voltage.

Here, now, is the point where an innovation may be made. Instead of giving each consumer the full supply voltage, the writer suggests the following arrangement :—

Assume a working voltage of 200 volts alternating, and that eight houses such as previously figured out requiring a maximum demand of ·042 KW. each are to be supplied, then the proposal is to install a balanced auto-transformer taking 200 volts across the outers, and having eight branches giving 25 volts per branch to supply the eight consumers.

This at once brings us into low voltages, where elaborate precautions are unnecessary for the safety of the users, and where, consequently, a much simpler and cheaper method of installation can be utilised.

(To be continued.)

* This figure is obtained on the basis of a "diversity factor" of 0·7, *i.e.*, 3 × 20 watts × 0·7 ÷ 1,000 = 0·042 KW.

CORRESPONDENCE.

Letters received by us after 5 P.M. ON TUESDAY cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.

Gas Turbines.

Like your correspondent "C. F. M.," I read with great interest the reference in your issue of May 15th to the problem of the gas turbine, and was a little disposed to write you at the time pointing out that a gas turbine did not by any means involve a rotary compressor.

I observe, however, that there is a serious error of another kind in the article in question, and the appearance of "C. F. M.'s" letter leads me to think that perhaps the matter is of sufficient interest to your readers for me to point it out.

Referring to your article of May 15th I quote :—"It is in three sections, with continuous cooling circulation, and was claimed to have delivered 1 cb. metre of air per second at 6 to 7 atmospheres with an efficiency of 60 or 70 per cent. It absorbed half the total power given out of the machine when developing 300 H.P. at 4,000 revolutions per minute."

Assuming isothermal compression and a working pressure of 6 atmospheres or 7 atmospheres absolute, also assuming 60 per cent. efficiency from the isothermal, a simple calculation will show that the B.H.P. required for the compression of the air alone is over 3,000. There is, therefore, obviously some mistake somewhere in the figures which you quoted from the pseudo-scientific magazine referred to.

The general question of supplying air for combustion for the gas turbine by means of a reciprocating compressor of our type is one which we have very carefully worked out in two or three instances, and the arrangement is, of course, a perfectly feasible one. In one case, involving a machine with a large rotor, and therefore relatively slow speed of rotation, the problem of direct coupling was not an impossible one.

In dealing with gas turbine problems, the amount of power necessary for the efficient compression of the air is a little alarming until it is realised that, with the reciprocating gas engine, the same question arises exactly. It is only because the indicator diagram of a four-cycle gas engine automatically gives the *net* area of the card *after eliminating the power which has been absorbed in the compression of the air*, that the ordinary student of the question overlooks for the time what a considerable proportion of the total power indicated on the pressure stroke of the gas engine is absorbed in compression before the next explosion takes place.

W. Reavell.

Ipswich, *June 2nd*, 1908.

Balancers.

With reference to the article on "Balancers" in your current issue by Mr. A. Imbery, there are one or two points which he deals with to which I take strong exception. On page 895, he says : "The starting resistances for balancers should, if possible, be provided with no-voltage release attachments, connected in series with the shunt field of each machine."

It has always been my experience, and I have heard it maintained by other engineers, that a no-voltage release should never be placed on a balancer starter ; in fact, that a balancer circuit should not even include circuit-breakers or fuses. The greater the number of these safety devices that are put in, the greater the risk of the balancer ceasing to work whilst on load. Circuit-breakers may open, fuses may blow, or no-voltage releases may allow the starter arm to slip. The majority of engineers would much rather risk damage to a balancer armature than have a general shut-down of supply, and probably burn out a number of lamps on the mains.

In the case of a shut-down of a lighting supply, the every-day switchboard attendant is not so likely to forget the balancer starter as Mr. Imbery suggests ; and if he does, the risk is not so great as it may appear at first sight. The main generator is switched on to the bars at about 50 volts, and this voltage across a 400 to 460-volt balancer set will not do the slightest harm whatever ; the machine will merely run up in the ordinary way.

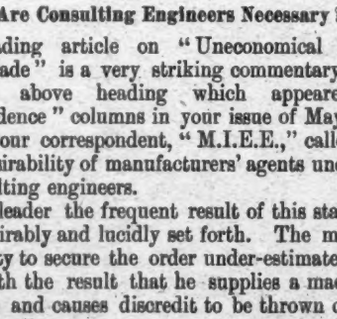
It is the practice in a number of stations to fit each generator panel with a fuse and circuit-breaker, and in the event of the machine being switched on to the bars at full voltage the circuit-breaker would blow before the balancer would burn out.

As regards the question of faults on the mains affecting the balancer, I should imagine that the writer of the article had overlooked the fact that in nearly all three-wire stations using motor-balancers batteries are also used, and that in the event of a fault on the mains the battery speedily rises to the occasion.

As previously stated, the majority of engineers prefer to risk damage to their plant rather than have a general stoppage of supply ; and as the balancer, and, in fact, all the plant in the station can be insured against breakdown for such reasonable premiums, it appears to me to be a wiser course, both commercially and technically, to take this risk than that of a general shut-down, the moral effect and damage of which cannot be insured against.

I may say that in the station with which I am connected we have a 25-KW. balancer-booster set which has been running for over 3½ years without either a circuit-breaker, fuse, or no-voltage release in the circuit, and we have never had the slightest trouble with either of the machines, although we have had a number of faults on the mains which have passed a considerably higher current than the balancer was built to deal with. We attribute the successful running of this set to the fact that it gets regular attention and that the insulation resistance of both armature and field is taken every week.

I notice in the drawings of connections that separate field resistances are shown. We find that we get much better regulation by only having one resistance in circuit for the two fields, and connecting the resistance to the middle wire bus-bar through the switch arm. This obviates the necessity of having to regulate two resistances. The connections are as follows :—



Middle Wire.

June 2nd, 1908.

Are Consulting Engineers Necessary ?

Your leading article on "Uneconomical Methods of Pushing Trade" is a very striking commentary on a letter under the above heading which appeared in the "Correspondence" columns in your issue of May 22nd. In that letter your correspondent, "M.I.E.E.," called attention to the undesirability of manufacturers' agents undertaking to act as consulting engineers.

In your leader the frequent result of this state of affairs is most admirably and lucidly set forth. The manufacturer in his anxiety to secure the order under-estimates the power required, with the result that he supplies a machine which breaks down and causes discredit to be thrown on electrical driving generally.

When the trouble arises the purchaser has no remedy, as first of all he will probably be informed that the quotation was for a motor of a certain horse-power, and that a motor of that horse-power was supplied ; and, in the second place, the period of the makers' guarantee has in all probability run out.

Another reason why trouble so often arises is that even if he wished to, the manufacturer cannot possibly devote the same time to investigating the circumstances of any individual case as would a consulting engineer retained specially for that purpose.

If every one of perhaps 30 firms is to spend time in settling the requirements of each individual works instead

of its being settled by one expert, it is evident that there is a waste of human energy which must be paid for, either by the purchasers or by the sellers. The net result is, as you say, that the whole electrical fraternity has suffered.

Surely the remedy is that the purchaser should retain an expert to investigate the conditions previously in his particular works, and to specify clearly what is required, and the contractor or manufacturer should confine his efforts to supplying the machines specified at the lowest price consonant with their fulfilling the conditions laid down.

An Observer.

June 2nd, 1908.

Unfair Trading.

I should like to draw the attention of the electrical contracting trade to the unfair system that is adopted by some of the "wholesale agents to supply to the trade," *re* the sale of tantalum lamps.

I have in my possession a red letter notice from such an agent marked "private," discounts to the trade only, and have this week come across two hotels which are quoted and supplied by the agents at full discount prices, in spite of the order given that consumers are to be charged at list price.

By this latter remark, I do not mean to charge at 2s. 6d. and then allow the discount (I could give an instance of this). I have also seen a written quotation from a wholesale agent to an hotel proprietor quoting same price as to a large contractor or dealer.

I think this complaint requires close investigation, as it is a serious matter to the trade when such unfair tactics are adopted, and I should like to hear what others have to say.

A Traveller.

June 6th, 1908.

Electrical Driving of Factories.

I should esteem it a favour if you, or any of your readers, could give me actual figures and facts relating to factories, breweries or distilleries where electrical power has been substituted for the old method of steam-engine driving, and also the results of the change, showing the saving it has effected.

If one could obtain a tabulated statement, such as the capital outlay per H.P. for changing over, and the saving effected per annum in the fuel consumption and general costs of power, it would be invaluable, and assist engineers in persuading factory owners to effect the change.

Horace Boot,
Consulting Engineer.

Electricity Works, Tunbridge Wells,
June 6th, 1908.

PARLIAMENTARY.

London and District Electric Supply Bill.

(Continued from page 941.)

WEDNESDAY, JUNE 3RD.

MR. J. CONACHER, manager of the Metropolitan Electric Supply Co., gave evidence regarding the existing companies. He said that, in his opinion, the authorised distributors were well able to deal with the demand for electricity. They had land capable of further extensions for meeting any future demands upon them. They were quite able to do the work as efficiently and economically as the promoters were proposing to do. If their lands and buildings were not capable of further extension, he might be inclined to accept the arguments of the promoters. His company's station was admirably situated to give a cheap supply, and he believed they could generate electricity as cheaply as was proposed by the promoters. Witness put in tables showing the number of units sold by the London electric supply companies, which showed that, in 1893, 10,232,958 units were sold, the revenue received (less bad debts) was £265,259, which worked out at an average price of 6·22d. per unit. In 1907 123,670,001 units were sold, which produced a revenue, less bad debts, of £1,549,762, showing an average price per unit of 3·01d. The authorised capital of the companies was £11,725,000, and the loan capital £7,475,013—a total of £19,200,013. The capital issued and paid up was £8,338,284, and the loan capital £4,833,684—a total of £13,171,968. The capital expenditure of the London companies up to last year was £14,686,706, and of that £1,203,861 had been written off, which left a net amount of £13,482,845. The units sold for power and heating and for temporary traction purposes were—

	Power and heating.	Supplied to L.C.C. for traction purposes.	Average price for power and heating.	Average price for traction.
1905 ...	17,027,283	18,229,271	1·86d.	1·48d.
1906 ...	21,213,828	10,343,679	1·49d.	1·36d.
1907 ...	27,139,664	4,268,835	1·37d.	1·00d.

The number of units sold in London for all purposes except traction was 158,202,633, which was 33·6 units per inhabitant; the revenue received was £2,026,304, showing the price per unit as 3·66d.

His company had bulk supply powers, but they had not exercised them except in Acton. They had one consumer taking over 250 KW. The company did not supply any railway or canal.

WITNESS was cross-examined at length by MR. FITZGERALD, who sought to show that the present companies could not generate as cheaply as they (the promoters) proposed to do. Mr. Conacher, however, maintained that they could.

The CHAIRMAN remarked that the witness made statements that they could generate electricity cheaply, but he (the chairman) thought he ought to substantiate his remarks.

Continuing, WITNESS said that no doubt it would require large sums of money to lay down distributing mains for supplying the whole of London, and he did not think the promoters had provided enough capital for that purpose. He admitted that they had a clause in their Bill (the Joint Committee's Bill), that if they were purchased in 1932 the capital was to be redeemed at a premium of £110 for every £100, together with a sum representing the loss of the revenue which might have been earned between 1932 and 1952.

MR. H. B. RENWICK, manager of the County of London Electric Supply Co., was the next witness. He said that the tables put in by Mr. Merz when he was promoting the Administrative Bill showing the number of horse-power supplied by the existing companies had been considered by them, and they were alarmed at the figures which that gentleman gave.

WITNESS was then examined at great length on the tables with reference to the horse-power requirements which were placed before the Committee which considered the Administrative Bill. He said that the managers of the electric companies had a meeting to consider Mr. Merz's statements, and it was then decided to make a careful, systematic and thorough canvass to obtain the statistics relating to the actual horse-power requirements. Accordingly they started to collect information in July, 1906, and they finished their canvass in the spring of 1907. It was found that the 13 companies were supplying power equal to 46 per cent. of the total requirements, and the local authorities supplied 25·1 per cent. of the demand. Their area was largely an industrial one, particularly north of the Thames. His company were willing to give a supply for power purposes under certain circumstances at a flat rate of ½d. per unit. For the first four years of their working they paid no dividend, then it rose to 4½ per cent. and then to 5 per cent., at which it now stood. They did all they could to push the power business; it was a misapprehension to say that they did not.

MR. E. W. SEALE, secretary of the Charing Cross and West End Electricity Co., also gave evidence as to the progress of his company. In his opinion the promotion of Power Bills had had a serious effect on electrical enterprises.

THURSDAY, JUNE 4TH.

At the resumed sitting of the Committee, MR. W. FORBES, the general manager of the London, Brighton and South Coast Railway, stated that his company had entered into a contract with the London Electric Supply Corporation for a supply of energy in connection with the electrification of the London Bridge and Victoria line, a distance of between 8 and 9 miles. Witness went into the details of the agreement, and pointed out that the Supply Co. were under severe penalties in case of a failure of supply. He thought that the line would have to be further electrified, at any rate to the extent of 40 miles.

In cross-examination by MR. FITZGERALD, WITNESS said the agreement with the London Electric Supply Co. was for 7 years, and at the end of that period the Supply Co. was to have the first option of a renewal. The penalties for failure ran up to £150 a day, and a clause provided for duplicate mains. For the first supply which would be on a low load factor the price paid varied from 1d. to ¾d. per unit, but when the load factor reached 35 per cent. the price was to be ¾d. per unit.

MR. E. W. SEALE, secretary of the Charing Cross and Strand Electric Supply Co., re-entered the box, and gave further evidence dealing with Clause 73 of the promoters' Bill which gives them the power to acquire undertakings. WITNESS pointed out that the result of the operations of the bulk company would probably depress the market price of the shares of existing supply companies, and the promoters, if able to acquire the undertakings on easy terms, would be able to create a dangerous monopoly. Since the introduction of metal-filament lamps, the income of his company had decreased by £2,000 per annum.

Questioned by MR. FITZGERALD, WITNESS said the fall in his company's dividends from 8 to 5 per cent. had, of course, caused a depreciation in the value of the shares. The figures which had been put forward by the promoters of previous Power Bills in recent years had caused the prices of existing companies to be

lowered, and this had caused reductions of dividend. He suggested that fresh competition by a power company, under conditions which he would not consider fair, would still further affect the price of their shares. He admitted that his company had gone into the City, and had competed with the City of London Electric Lighting Co., but that competition was altogether different to the competition proposed under the Bill. It was true that his company quoted 2d. per unit for a bulk supply in 1905 on a 42 years' agreement.

MR. FITZGERALD pointed out that when the Administrative Co.'s Bill was before Lord Camperdown's Committee in 1905, he was stopped when he was proceeding to cross-examine on the point of the bulk company purchasing the existing supply undertakings on the ground that the Committee would take such a suggestion for what it was worth. WITNESS said however that might be, a clause was inserted in that company's Bill to prevent them acquiring other undertakings. He admitted that had the West Ham Corporation entered into a 42 years' agreement with his company for a supply at 2d. per unit, they might not in the light of subsequent events had made a good bargain, but there was a clause in the agreement to provide for a revision of prices at certain periods.

MR. HARRISON, secretary to the City of London Electric Lighting Co., said there were four power-users in his company's area whose maximum demand was for 250 KW., and the revenue from them was £11,879. The revenue from street and public buildings lighting was £14,990; and for railway lighting purposes, £2,427. All this revenue could be competed for by the power company. The total number of power-users in the city was 1,048.

MR. FITZGERALD pointed out that witness's figures as to the number of power-users were very much at variance with the contention constantly put forward by Sir R. Littler on behalf of the City Corporation.

MR. C. P. SPARKS, engineer and manager of the County of London Electric Supply Co., put in a number of tables to show that the estimates of the promoters of the probable profit to be derived from supplying authorised distributors in bulk if calculated upon the actual conditions of to-day would result in a great loss to the promoters. His opinion was that the promoters were estimating with insufficient knowledge of the actual conditions under which the companies were now working, and consequently their deductions from the published accounts were quite incorrect. The promoters had estimated that the cost of generating additional units for the present output in the future would be ·5d. per unit, whereas experience had shown in his own case that this would only cost ·35d. per unit. In fact, his company, since 1905, had generated an additional 22,000,000 units at an extra works cost of ·8d. In addition to this, he calculated that there would be a saving by the linking-up process suggested in the Bill which the supply companies were promoting.

MR. BALFOUR BROWNE, K.C., then addressed the Committee on behalf of the existing companies. He said that he agreed with what had been stated by Mr. Sydney Holland, that the preamble of the Bill had not been proved, and he would therefore ask the Committee to say that, so far as that Bill was concerned, it should not proceed. The words of the preamble were: "That whereas the supply of electrical energy in the area hereinafter defined is now in the hands of various local authorities and companies who respectively have powers of supply in certain limited areas, involving the construction and maintenance of a large number of separate generating stations and undertakings, and by reason thereof the generation and supply of electrical energy is unduly expensive, thus limiting its use, and it is expedient that electrical energy be generated and distributed on such a scale and on such terms as will enable it to be used more extensively for industrial and other purposes." He submitted that there had not been one tittle of evidence before the Committee to prove that electrical energy was so expensive as to limit its use. Everybody who had come before them had said that they got their current at a moderate rate. Of course there were always persons ready to say they would like to get it cheaper. The companies had sunk a very large amount of capital—£13,842,000—in the enterprise of supplying light and power to London. Although at one time they were solely electric lighting companies, he thought they would agree that power had now become an important part of the business, and they had done their best to foster and encourage that business, and had succeeded as well as anybody could in London. They were supplying in the City 84 per cent. of the total power required. Where the field was left for the new companies he did not know. There had been a popular superstition abroad ever since Mr. Merz gave evidence before a Parliamentary Committee that the companies were only supplying 5·7 per cent. of the whole of their area, and in the industrial area only 4 per cent. of the power that was required. Those statements were very startling. It looked as if the companies had neglected their opportunities. Those statements were repeated in 1906 by Mr. Llewellyn Smith, but then the figure had increased to only 7·28 per cent., although the companies had been extending their operations in all directions. It was upon those statements that an erroneous impression had been created. Lord Onslow in the Upper House, when moving that a Joint Committee of both Houses be appointed to consider that Bill, had stated that the supply of electricity was almost approaching a scandal. Mr. Lloyd-George, in the House of Commons, said that there was a general feeling that something ought to be done, and it was a great scandal that something had not been done before. The foundation of those statements was Mr. Merz's remarks. He (Counsel) ventured to say that the companies and the local authorities had done their very best to get the power load, and had succeeded to a wonderful extent in supplying the real wants of the people of London. Had anybody been called before the Committee to say that they wanted electricity, and could not get it—not one? No one had come to complain of the supply. As they had heard from witnesses, in the whole area of London the companies were supplying 46 per cent. of the whole power requirements, and the local authorities 25·1 per cent. The existing companies opposed the Bill because, in the first place, to introduce a new company into London was, in their opinion, a breach of a Parliamentary bargain; secondly, they said it was a competitive scheme, and would take away their best customers if it ever got on its legs; it was also competitive with the existing companies who covered all the ground that there was to be covered; thirdly, there was no one in their area who could not get electricity at a reasonable price, and therefore there was no room for the promoters. He asked the Committee to say that they were not satisfied with the financial proposals of the promoters, and even should they be able to raise the capital, no return would be possible to the shareholders, except out of capital, and if so it would have to be paid by the purchasing authority in the long run. The problem of the supply of electricity to London, instead of being solved by that Bill, would be postponed for years. Should both of the promoters get their Bills, it would be a very hard thing for both of them to get money. The Bill would interfere with the raising of money, as it would make it increasingly difficult to obtain fresh capital. The existing companies had been placed under serious restrictions which had, to a certain extent, crippled their industry. Those restrictions had been placed upon them by Parliament, and, therefore, they claimed the protection of Parliament, unless there was some strong reason why their concession should be over-ridden. He was prepared to face the competition of other companies, because they were in the same position. The promoters, however, were not. The company asked that their dividend should be made up to 6 per cent. from their commencement—his companies were in a totally different position. The promoters also asked for a longer concession and a wider area than any of the existing companies had. If he could have made a bargain with the other companies he could have done what the promoters proposed to do, turn the small stations into peak load stations and generate on a large scale—but he was restricted from doing that. Counsel then proceeded to give instances to show that Parliament did not allow competition, and asked that if there was to be competition it should be on fair terms. There were 13 companies who all believed that they would have 42 years' working at the time when they invested their money, but if they allowed that company to come in, what became of their tenure? "If Parliament," said counsel, "allowed that company in they were taking away their concession, and that was a breach of a Parliamentary bargain." The Committee knew that under the Electric Lighting Act, 1882, the companies were purchaseable at the end of 21 years. That Act was amended by the Act of 1888, which extended the time to 42 years, and it was on that tenure that the companies had raised money. He contended that Parliament ought not to interfere with their concession. The companies had carried out their bargain. Had they paid an exorbitant dividend? The average dividend was only £3 18s. 2d. since their commencement. That was not very large when they remembered that they had to lay by a sinking fund. As to competition, Mr. Hammond, for the promoters, had said that they did not want their consumers, they wanted the bulk custom of the companies. It was absolutely absurd to suppose that any authorised distributor was going to the District Co. for a supply. If they did so, instead of making a saving, they would lose. The District Co. said themselves that they could only work at the estimated prices if they got a load of 60,000 KW., and they could not obtain such a load unless they went to the consumers. Therefore, if they did not want the consumers as their witnesses had stated, the company could never get upon its legs, and would it not be the height of folly for the existing companies to take a supply from the bulk company in order to enable them to compete with them. If the District Co. was relying upon customers, they could only get them by stealing them from the existing companies, or by bargaining with one of the companies. If they were relying upon the authorised distributors to go to them, they were under a false impression, as not one of them would take anything from the promoters. The only chance of the promoters was to compete for the large consumers above 250 KW., and if they did that it would have the effect of increasing the cost to smaller consumers. The promoters also said that there ought not to be two power companies, but at the same time they were proposing to compete with power companies. Some of the companies, as they had heard, had powers to give a bulk supply, and, therefore, what chance had the promoters. There was no power company in this country that kept specifically to power business, that had succeeded. The only one that could be quoted was the North Metropolitan Co. which paid a dividend last year. But so important did they regard the distribution powers that they came to Parliament last year and got powers authorising them to distribute. Mr. Merz's company in Newcastle was a power company, but it was also a distributing company. The Yorkshire Co., although primarily a power company, had taken over a number of orders, and was thereby a distributing company. He defied the promoters to point out a company which had been successful which had not taken up the distribution of electricity. There was not one. The promoters would also compete with them for public lighting, if, as under Clause 75, they had power to, they purchased another undertaking. That was a serious matter. He represented eight companies, and they were all as one that day, but it was quite possible that in time to come one company might not be so prosperous as the other. In that case the promoters might approach them with a view to purchase, and it was quite likely that they would succeed, and then they

would enter into direct competition. Again, the promoters could compete with them for railways, they could compete for consumers over and above 250 KW. Regarding the 20 per cent. lighting clause, in many cases 20 per cent. was sufficient for a consumer's whole lighting; 20 per cent. nowadays was a totally different thing from what it was formerly. The introduction of the metallic-filament lamp gave three or four times the amount of light with the same quantity of current as before, and in that case, instead of 20 per cent. it meant 60 per cent. or 80 per cent. In everyone of the ways he had mentioned, there would be active competition between the promoters and the companies. As to the prospects of the scheme, Mr. Falconer had told them that the condition of things had totally changed. As they knew, the Bill was being promoted by two able engineers, but his clients did not believe that they would get the capital. If they got the Bill they would have something to negotiate with. It was such a position that Mr. Falconer had said that he and his fellow promoters would have nothing to do with. He submitted that the suggestions of finance were of the shadiest character. Mr. Hammond had said that the whole question depended upon the money being raised. If the Committee passed the Bill, and they could not raise the capital, it would do serious harm to the companies. The companies would not be able to find capital if the promoters were appealing to the market for £3,000,000 or £4,000,000. Witnesses had stated that they must have contracts to raise money, yet he (counsel) had said that they could not expect to get contracts from them. The Bill had not the financial backing that other large schemes had had when they were before Parliament. All the Committee had heard was that Sir Hugh Bell was willing to be responsible for £350,000, and Lord Fitzwilliam had written that he would be responsible for a sum to the best of his ability.

The CHAIRMAN reminded Mr. Balfour Browne that the L.C.C. had said they were agreeable to the figure of £600,000 being found within one year.

MR. CLEASE, for the L.C.C., said that their point was that the Bill should be a real attempt to solve the problem and not a Bill that would be hung up. They wanted the Committee to be satisfied as to the finances of the undertaking.

MR. BALFOUR BROWNE, K.C., continuing, said it really did not matter to him what attitude the L.C.C. took. It was not true that the promoters could get money. The other power companies had found money at the first onset, but had not afterwards succeeded. The real solution of the problem of the electric supply of London would be found when he brought his Bill forward—the London Electric Companies' (Joint Committee) Bill. Instead of solving the difficulty, the promoters' Bill retarded the developments that were taking place, and instead of benefiting the consumer, it would interfere with them. As to passing both the Bills, the Bills both provided for a bulk supply. The promoters' Bill contained extensive power of competition for the companies' existing business, but he contended that the authorised distributors did, and were well able to, meet the demand. The promoters also had a longer length of concession, they also had power to pay interest out of capital, and they had power to distinguish between customers. In all those respects the promoters were in an unfair position, as compared with the companies. There was no room for both customers, because seven-tenths of the business was in the hands of the companies, and the remaining three-tenths was business which would never come on electrical mains at all. The real method of cheapening the supply was to allow companies to develop by removing the inconsiderate restrictions to which they were at present subjected. They could do what the promoters could do if they were unrestricted. It was utterly absurd to suppose that what £20,000,000 of money could not do, £6,000,000 was going to do. Broadly, if they allowed the Bill to proceed, it would, he submitted, be a breach of a Parliamentary bargain. Secondly, it was a violently competitive scheme, and could only succeed even in a modified form by stealing customers from the existing companies. Then there was no guarantee, should the Bill pass, that the capital would be forthcoming, and he deprecated very much the passing of the Bill, because, as he had said it did not solve the question, but shelved it, and would impede t e progress and the development of the companies.

The Committee adjourned till June 16th.

Damage to Cables by Trawlers.—In the Parliamentary papers for June 4th, Mr. Owen Philipps asks Sir E. Strachey whether he has received any complaint from the Commercial Cable Co. with reference to the alleged damage by trawlers to the deep-sea cable off the Irish coast, and if where the alleged damage occurred the depth of the sea is over 300 fathoms; and whether it is possible for even the largest and most modern trawlers from Milford Haven or elsewhere to trawl at this depth.—Sir E. Strachey replies that the Commercial Cable Co. have not communicated with the Board on the matter to which his friend refers, nor were they aware of the exact depth of the sea where the damage to cables has been done. They have reason to believe that trawl warps are now made of such length that trawling is not impossible at a depth of 300 fathoms, but the information at present available goes to show that in point of fact it has not been carried on at such a depth.

Swindon.—The T.C. has applied to the L.G.B. for a loan of £8,000 for additional generating plant and extensions to the public arc lighting.

BUSINESS NOTES.

Consular Notes.—MEXICO.—The German Consul at Mazatlan reports that communication between Mazatlan and San Jose del Cabo by means of wireless telegraphy was set in working order at the beginning of the summer of 1907, when the installation of the lower Californian division was completed, the Mazatlan station having already been finished in the year 1906. The installation worked with every satisfaction, although before it was taken over by the Government from the agents of the contractors, the Gesellschaft fur drahtlose Telegraphie in Berlin (system Telefunken), the storm had wrecked both the iron towers in San Jose del Cabo. These towers have now been taken away and brought to Mazatlan and installed afresh.

ITALY.—The German Consul in Venice reports that the installation of a tramway system which had been proposed for the provinces of Treviso and Venice, and for the construction of which a company had been formed in Belgium, has now again been postponed. The municipal tramways of Udine and Padua were converted into electrical lines, and it is proposed to install electric traction on the secondary railway from Fusina to Padua. The electrical company for the utilisation of the water powers in the province of Venice are continually increasing their deliveries of energy for lighting and power purposes. The gas works established in Venice have increased the price of their gas from 20 centesimi to 36 centesimi.

INDIA.—The German Consul at Bombay reports that the trade in electrical machines has increased in value about 1,120,000 rupees in consequence of the increase in the number of electrical works in Bombay and district. It is anticipated that this trade will increase still more in the future since the installation of electricity is proposed in the municipalities of Ahmedabad, with its numerous cotton factories, and Puna. Great Britain took 96 per cent. of the total trade in machines in 1906-7, that is, 24,600,000 rupees. The deliveries were chiefly textile, steam, and electrical machines. Other machines such as pumps, printing presses, machines for mills and saw works, were imported chiefly from Germany and the United States.

BELGIUM.—The French Consul at Liége reports that in spite of the undoubted competition to steam engines which is being made by gas motors and turbines, the demand for heavy machines has been very great during recent years. Belgian houses have attained perfection in the construction of these machines to such a point that the market is quite inaccessible to foreign competition. The rates of duty leviable in foreign countries makes the exportation of the Belgian product very difficult. The use of the multitubular boiler has continued to increase, and the majority of the new works have adopted it. Competition in boiler tubes is very keen, the large German producers sending abroad the surplus of their production according to the degree of activity of their works. The electrical industry represented by numerous works engaged in the manufacture of dynamos, lamps, and electrical apparatus of different kinds, is being greatly developed in Belgium. This country which formerly was obliged to have recourse to foreign electrical works has now itself become an exporting market. The installation of large steel works and new rolling mills has been the the source numerous orders to constructors of specialities. In this branch, however, home producers have to contend against German and French competitors whose products only pay low rates of duty. The manufacture of lighting plant has been in a very good condition, orders being numerous and prices remunerative.

GERMANY.—The Austrian Consul at Dresden, in a recent report dealing with the electro-technical industry, states that in general the year 1907 left nothing to be desired. The production was appreciably higher than in the previous year, and considerable contracts were entered into for 1908. Production in the incandescent lamp industry was much the same as in the previous year, although the competition of the metal-filament lamp narrowed the demand. The sections in which lamps for telephone and lighting purposes, including advertisement lighting, are produced is developing satisfactorily. The installation of lighting and power plant shows an increase which was anticipated in consequence of the extension of old works and the construction of new, particularly in mining and metal works.

PORTO RICO.—The *Export-Zeitschrift für Elektrotechnik* states that in 1906 the Porto Rico Railways Co., Ltd., was formed by Canadian contractors and a building company in New York for the purpose of constructing an electric railway between the towns of Caguas and San Juan in Porto Rico, and hydraulic works for the production of electricity for the railway as well as for lighting and power purposes in San Juan and district. Previously Caguas had no railway communication with the coast; tobacco and other products were sent from there to the sea by oxen wagons. The railway will be the first to penetrate into the island and will join up with the electric tramway system of San Juan and its suburbs. With the Porto Rico Railway Co. were incorporated the San Juan Light and Transit Co. and the Porto Rico Power and Light Co., and at the same time two sister companies were established, viz.:—The Comerio Water Power Co. and the Caguas Tramway Co., the former for the installation of hydro-electric works, and the latter for the construction of the railway. Formerly, all the electric power required in San Juan and district for railways, lighting, and motors, was supplied by the San Juan Light and Transit Co. and the Porto Rico Power and Light Co., by each of whom electrical works with steam power were being exploited.

NICARAGUA.—According to a report of the American Consul in San Juan del Norte, the Government of Nicaragua has granted to a certain Senor R. J. La Villebauvre, in Managua, the exclusive privi-

lege to appropriate and exploit for the next 20 years a certain gutta-percha from the Tuna tree. The concession covers all the Tuna trees in the national lands in the district of Cabo Gracios a Dios, Prinzapolka, in the department of Jinetonga, and in the part of new Segovia which lies east of the 86 meridian. The Government undertakes to pay 2 cents for every kilogramme of the gutta-percha produced, whether it is worked up in the country or exported. During the period of the concession the concessionaire may import free of duty all the machines, tools, chemicals and other material necessary for working the concession. He also has the right to sublet the concession to another contractor or syndicate, but under no condition must he let it to a foreign Government. The Tuna tree belongs to the family of the Balata tree. The species Tuna is indigenous to Nicaragua, and is particularly abundant in the district of Cabo Gracias. The tree is similar to the rubber tree, and its fluid possesses the colour and consistency of raw caoutchouc, but it altogether lacks elasticity. The price of the product is said to vary between 7 and 25 cents per pound, although it has no real market price. It is anticipated that there may be a considerable demand for the Tuna gutta-percha, and in that case the concession will assume considerable importance.

Dutch East Indies.—The British Consul at Batavia, in a recent report, states that considerable interest continues to be evinced in the cultivation of the rubber producing trees throughout Netherlands India, and the suitability of the climate and soil, coupled with undoubted labour advantages which Java possesses over most other tropical countries, has resulted in a steadily increasing trend of European capital towards rubber enterprises in the colony. According to statistics lately compiled the capital of British companies interested in rubber in the Dutch East Indies, but domiciled in the United Kingdom, amounted to nearly £1,500,000. This, however, does not include the numerous companies formed during the last few years, also with British capital, but domiciled in Java, which may be estimated at another £250,000. The first congress of rubber planters was held in October last, and it was resolved to institute an experimental station with nurseries which should prove of valuable assistance to rubber planters. The area at present under cultivation is estimated at some 58,000 acres in Java, 25,000 acres in Sumatra, and 7,000 acres in Borneo, of which most of the older rubber and nearly all that is bearing (say one-half of the acreage) must be Ficus elastica as the cultivation of the Para variety dates only from 1905 onwards. At present, therefore, exports are still inconsiderable, but in the course of a few years the Dutch East Indies should prove an important factor in the rubber markets of Europe.

Chile.—The British Consul at Coquimbo, in a recent report, states that mining, principally for copper, is the staple industry of the district, and this industry, with copper smelting, gives occupation to many hands, besides creating a demand for imported fuel, and for the many foreign-made tools and accessories required in the trade as well as pumping and other machinery. In connection with one of the copper works there is a plant for the manufacture on a large scale of sulphuric acid, and at an inland station plant is being extended for electric precipitation of copper from water pumped out from a set of old mine workings. There are, furthermore, dotted about the province several installations for the treatment of copper ores by the acid process.

Italy.—The British Consul at Rome reports that the Rome trams have tried to keep pace with the extension of the city, but local topographical conditions are not very favourable owing to the hilly character of the town itself and the narrowness of some of its old streets. The tramway company complain in their last annual report that their efforts to extend the service does not find a satisfactory response on the part of the municipal authorities who seem either slow or reluctant in sanctioning the desired new concessions, notwithstanding the fact that during 1907 the tramway company, pursuant to an existing agreement, contributed to the municipal funds a sum of £27,572, their share of the year's profits, as against £27,346 distributed among the shareholders. The passenger traffic on the lines seems to be increasing regularly:—

1903	...	27,356,019	1906	... ...	36,239,511
1904	...	31,256,405	1907	... ...	43,849,583
1905	...	35,018,967			

Since the issue of the tramway company's report, the Mayor of Rome has made a statement embodying the views of the administration in regard to the tram service. The municipality does not contemplate buying out the existing company, but will construct lines of its own. It is generally held that the public will benefit by a competition of this kind. A similar statement was made with regard to the gas supply.

Honduras.—The British Consul at Honduras, in a recent report, states that the electric lighting of the streets of Tegucigalpa, projected for many years, was inaugurated on September 15th, 1907, with some 70 arc lights, which have been very successfully used ever since. The lighting of private houses by means of the same plant is now being gradually extended.

Norway.—The British Consul at Christiania, in a recent report, states that the factory at Notodden for the manufacture of calcium nitrate from air and limestone by the aid of the electric arc has lately expended 60,000,000 kroner on these works, which are under construction, and will have an equipment of 32 large electric furnaces, each furnace requiring 1,000 h.p. The cellars below the furnace room contain the large air-conveying pipes and the eight electric fans which supply air to the furnaces. There are nine granite-built absorption towers, each 75 ft. high. The output from these works is expected to reach 20,000 tons per year, the value being something like 4,000,000 kroner. The Svaelgos power station is the largest of its kind in Europe, being able to develop 40,000 h.p., and is only second in size to that of the Ontario Power Co. at Niagara. The building has a length of 62 yards and a breadth of 12 yards. There are four turbines of 10,000 h.p. each, 23 ft. × 13 ft. 3 in., each driving its own generator. These generators weigh 110 tons each, and run at a speed of 250 r.p.m. The same firm is now harnessing the Rjukan waterfall in Thelemarken, which is calculated to give about 220,000 h.p. The grand total of horse-power that can be brought into use from the Thelemarken sources at a reasonable cost is calculated to represent about 600,000 h.p., being larger than any other water-power district in Europe can produce. This presents the greatest opportunities for electro-chemical works of great magnitude, as the power can be had at a reasonable cost.

Later in his report, the Consul states that owing to the increased demand for telephone apparatus in Norway, the Elektrisk Bureau, Ltd., of Christiania, have decided to enlarge their works. These are to be made 50 per cent. larger than they are at present, and will give employment to 50 additional men. The demand for these instruments is increasing rapidly, especially for Chile, Argentine Republic, Mexico, the United Kingdom and the Netherlands, as well as other countries.

Catalogues and Lists.—Mr. Woolnough, manufacturer, Norwich.—List of trade prices for semi-enclosed bi-polar and multipolar motors of from ½ to 2 b.h.p. in the former, and from 3 to 50 b.h.p. in the latter, case.

Lahmeyer Electrical Co., Ltd., 109/111, New Oxford Street, London, W.C.—Four-page illustrated circular describing their turbo-generators. We understand that a large number of these machines have been supplied for mining work. The manufacturers of the Zoelly turbine (Escher, Wyss & Co.) are now affiliated with the Lahmeyer Co. In less than three years Zoelly turbines representing an output of 359,000 h.p. have been ordered.

Messrs. Hogan & Wardrop, Gloucester Mansions, Charing Cross Road, W.C.—Illustrated pamphlet giving particulars and prices of their various types of direct and alternating current fans, also some small power motors and grinding machines.

Bryant Trading Syndicate, Ltd., Horsell Road, Highbury, N.—Illustrated circular giving prices of, and points to remember regarding, their British "Metalite" electric lamp.

Messrs. Hans Renold, Ltd., Progress Works, Brook Street, Manchester.—New pamphlet (28 pages) entitled "Chain driving compared with belt driving for automatic lathes," in which is given an account of the results of driving Browne & Sharpe automatic turret-forming machines by Renold silent chains instead of by leather belts. The pamphlet is fully illustrated. Copies may be obtained by those interested, on application to the above address.

Messrs. Richard Pape, Ltd., Albion House, New Oxford Street, W.C.—Catalogue giving illustrations, particulars and prices of their new "Fors" accumulators for ignition and lighting service. An output of 18 watt-hours per lb. of complete cell is guaranteed.

Messrs. Lassen & Hjort, 52, Queen Victoria Street, E.C.—Copy of the firm's "Gazette" in which they discuss the economy of water softening.

Messrs. Korting Bros., Ltd., 53, Victoria Street, S.W.—Catalogue No. C3 (12 pp.) containing a description, with line and other illustrations, of their improved multi-jet ejector condensers. Tables of dimensions in inches and millimetres, also a table of low-pressure steam, are given. A brief account appears of their automatic exhaust relief valves.

Pulsometer Engineering Co., Ltd., Nine Elms Iron Works, Reading.—52 pp. catalogue, fully illustrated, giving particulars of their Pulsometer steam pumps of standard and special patterns, also of fittings for same. A number of views show various applications of the pumps. A quantity of general business information is published.

Australian Preferential Tariff.—Messrs. Neale and Wilkinson, Ltd., of 32, St. Mary Axe, London, E.C., write as follows:—"By the mail just in from Australia we have been asked by our agents to specially notify shippers to that country of the new Customs Regulation:—'All invoices must be accompanied by a declaration signed by the responsible head of the firm, and, in the case of a company, bear the company's seal or stamp, and all signatures must be duly witnessed. In the absence of such declaration, goods will be charged at the higher rate of duty.' In view of the importance of this matter to British exporters, we should feel obliged if you would kindly notify same in your columns."

Dissolutions and Liquidations.—Brockie-Pell Arc Lamp, Ltd.—Creditors must send particulars of their debts, &c., to Mr. H. McLellan, 6a, Devonshire Square, London, the joint liquidator with Mr. R. Warner and Mr. Duncan Watson, by July 6th.

Gardner Electric Drill and Hammer Co., Ltd.—A meeting is to be held at Salisbury House, E.C., on July 8th, to hear an account of the winding up from Mr. F. P. Fuller, the liquidator.

Mica Boiler Covering Co., Ltd.—A petition presented by R. Swan Hunter and Wigham Richardson & Co., Ltd., for the winding up of this company is to be heard in London on June 17th.

Alsop Flour Process, Ltd.—Creditors of this company must send particulars of their debts, claims, &c., to the liquidator, Mr. J. Abernethy, Dashwood House, E.C., by July 13th.

Kevan Electric Co., Ltd.—In the High Court on June 2nd, a winding up order was made in this case.

Trade Announcements.—The McGraw Publishing Co., of New York, which has for some years owned the *Street Railway Journal*, has now purchased the *Electric Railway Review*, and

in future the two papers will be combined as the *Electric Railway Journal*, the new arrangement commencing with the issue of June 6th.

Mr. Edwin H. Judd has opened an office at Grosvenor Buildings, 68, Gordon Street, Glasgow, as engineer and merchant, and has been appointed sole agent in Scotland for Messrs. Brook, Hirst & Co., Ltd., electrical engineers, Chester; Messrs. Henry Berry & Co., Ltd., hydraulic engineers, Leeds; and Messrs. A. Bolton & Co., superheater specialists, Manchester. Mr. Judd was for several years in charge of the high-speed engine department, &c., of Messrs. Alley and McLellan, Ltd., Glasgow.

Bankruptcy Proceedings.—William Wardle, electrician, Levenshulme, Manchester.—The first meeting is to take place on June 17th, and the public examination on July 3rd, both at Manchester.

Albert Lord, electrical engineer, Manchester.—First meeting, June 18th; public examination, July 3rd, both at Manchester.

Ernest Goacher, electrical engineer and ironmonger, Worksop.—First meeting, June 19th; public examination, June 25th, both at Sheffield.

Book Notices.—"Electro-Metallurgy." By J. B. C. Kershaw. London: A. Constable & Co. 1908. Price 6s. net.

"Canadian Society of Civil Engineers; Charter, By-Laws and List of Members." Montreal: The Society.

LIGHTING and POWER NOTES.

Arbroath.—The Electric Co. have commenced the opening-up of the streets for the laying of the cables. The station is now nearing completion.

Barrow.—The L.G.B. has informed the Electricity Committee that it is not prepared to extend the period for the repayment of a loan of £767 for meters.

Bath.—The *London Gazette* of Tuesday last contains full notice of the intention of the Council to transfer its E.L. undertaking and powers to the Bath and District Electric Supply Co., Ltd.

Batley.—Whilst the net profit on the Corporation's electricity works only amounts to £121 for the past twelve months, as compared with £494 for the preceding year, the actual revenue (£5,912) is £202 better than in the previous year. The coal bill is £117 up. The wages have been increased by £157, and £194 more has been paid for rates, interest, and sinking fund. These three items alone amount to £478. In addition, £88 has been paid this year out of revenue for mains and services previously charged to capital account, whilst £147 less has been received from the Traction Co. for energy.

Blackpool.—The electricity accounts for the past year show a gross revenue of £36,565 (private lighting £19,566, tramway supply £1,544, public lighting £6,097, and sundries £358). The expenses were £16,140, leaving a gross profit of £20,425. There are 1,176 consumers. The capital expended during the year was £9,279, making £199,052. The accumulated sinking funds amount to £42,423, and there is a balance at credit of reserve fund of £6,153.

Bolton.—The Musgrave Spinning Co., Ltd., one of the most powerful cotton concerns here, is introducing electrical power at its three mills. Two mills and a portion of a third will be operated from one source.

Burnley.—A coal-handling plant costing £1,818 is to be installed at the Corporation electricity works.

Burslem.—The E.L. Committee has authorised the engineer to arrange an exhibition of electrical appliances at the Park fetes.

Bury.—The T.C. hopes to transfer £1,500 to the relief of the rates this year, as well as to adopt a scale of reduced charges from July 1st.

Cardiff.—The Corporation has at last obtained permission to lay cables for supply on the Bute property at Cardiff Docks. One of its first customers, the Hills Dry Dock, will require anything from 800 to 2,000 H.P.

Continental Notes.—Italy.—The Prefecture of Macerata has granted a concession to Sigg. Umberto Serafini e Aurelio Marini di Matelica for an appropriation of water from the Potenza, in the territory of Castelraimondo, for the production of electric power. The Prefecture of Parma has received an application from the Società elettrica Eridano di Cremona for a concession for an appropriation of water from the Ceno, for the generation of electric power.

Application has been made to the authorities of the province of Forlì for a concession to put down a plant to utilise the water-power of the River Savio in the generation of electrical energy for lighting and power purposes in the Savio Valley.

Crewe.—Mr. H. H. Denton, electrical engineer, reports that there is a surplus on the year's working of the electrical undertaking of £876. The working expenditure was £5,859, which averages 2·61d. per unit.

Devonport.—The annual report of the Electricity Committee shows that 1,695,289 units were sold, as against 1,719,462 in the preceding year. The total B. of T. units generated were 2,111,390, of which 453,318 units, or 21·5 per cent., were taken by private consumers; 26,722, or 1·3 per cent., were used for public lighting; 1,193,447, or 56·5 per cent., for traction purposes; and 21,802, or 1 per cent., for motors, making a total of 1,695,289, or 80·3 per cent. The works consumption was 149,912, or 7·1 per cent., which brought the total units accounted for, to 1,845,201, or 87·4 per cent., leaving 266,189 units, or 12·6 per cent., unaccounted for. The output was 19,848 units less than the previous year. The number of consumers is 351, an increase of 49 on the year. The average per unit was 2·277d. The decrease in sales was 24,173 units, or 1·4 per cent., which was principally in private consumption. The total income was £16,082, a decrease of £932, or 5·5 per cent., and the gross profit was £6,790, or 5·67 per cent. Interest and sinking fund absorb £6,786, or ·961d. per unit sold, leaving a net profit of £3 14s. 4¾d., against £2,196 6s. 10d. in the previous year, the principal cause of the decrease being the high price of coal.

Dover.—The T.C. last week had before it the estimates for the electricity department for the current year. It is hoped that a reduction may be effected by a saving in the cost of coal, tenders for which are now due. It was decided that in view of the estimated deficit caused by heavy capital charges consequent upon the limited period for repayment of loans allowed by the L.G.B. and the Board's requirement for payment out of revenue of amounts formerly charged to capital, it was necessary that the charges for energy should be revised as follows:—(1) Maximum demand rate—An increase of 1d. upon lower priced units, making 7d. and 4d. instead of 7d. and 3d. as at present, being equal to an average of ½d. per unit. (2) Flat rate—Reduction of cash discount from 1d. to ½d. per unit. These rates take effect from July 1st. It is anticipated that an increase in revenue from prospective contracts with the Admiralty Harbour and Duke of York's School will further reduce, if not completely cover, the estimated deficit. It was decided to purchase a booster (cost £700), by which an estimated saving of £500 per annum will be effected.

Dudley.—The annual report of the Corporation electrical undertaking shows that the total capital expenditure now stands at £86,809, compared with £81,411 last year. The year has been one of steady growth in the number of new connections made to the mains, the prominent feature being the increase in the number and H.P. of the motors taking supply. There has also been a larger amount of current supplied to the Tramway Co. than hitherto. The amount of energy sold has fallen slightly below the engineer's estimate, owing to the exceptionally bad trade which has prevailed since Christmas, this falling-off being noticeable under every head of supply. The year's gross profit was £5,977, an increase of £733. Financial charges for interest, repayment and bank charges absorb £5,641, an increase of £465, and the surplus is £336. The total unappropriated profits are £871.

Dunfermline.—Messrs. Gibbings & Chauntler, Liverpool, have withdrawn their offer to erect a generating station and carry on the undertaking until the revenue proved sufficient to cover the charges. Sir Alex. Kennedy is now in communication with the Fife Power Co., and it is stated that as the basis of an agreement the company would grant the Corporation the option of acquiring certain cables at the end of a number of years, and also the transfer of certain customers whose consumption does not exceed 4 H.P. The latter concession would practically mean that the burgh would have all the lighting customers.

Eastbourne.—The annual accounts of the electricity department are described as fairly satisfactory. The expenditure was increased by £2,000, £1,250 of which went in higher cost of coal. The £2,214 net surplus is to be carried to depreciation.

Epsom.—The U.D.C. is applying to the L.G.B. *re* a proposed loan of £1,500 for mains extensions.

Farnworth.—The electrical engineer (Mr. R. B. Leech) has prepared a specification for lighting the baths with electricity. He has also submitted a scheme for lighting the new town hall now being built, with 206 lights and 163 switches, the cost with oxidised fittings being £470, and he has completed arrangements for a partial supply of energy in bulk from the Lancashire Electric Power Co., Ltd.

Finchley.—The annual accounts of the U.D.C.'s electricity undertaking showed that the total income, less bad debts, was £11,489, of which £8,002 was contributed from private lighting, £1,685 from public lighting, and £642 from power. Working expenses were £5,939. The net result on the 12 months was a deficiency of £292. The chairman of the committee, Mr. Todd, said that the capital expenditure on the year was £12,638. The units generated were 897,502, as against 890,000 in the previous year. The total units sold to consumers had increased from 464,212 to 485,060; public lighting, 244,700 units, as against 238,300 in the previous 12 months; 55,753 units had been used at the works, as against 67,000. The number of consumers increased from 1,089 to 1,476, and the average receipt from each was between £5 and £5 10s. The income from power, &c., was only about half as much as in the previous year, owing to the fact that the Council had lost the bulk supply to the tramway company. This loss, however, had been more than made up by the increase in private consumption, and the rate paid per unit had increased from 3·6d. to 4·275d. Public lamps had been supplied at a cost of 1·52d., as compared with 1·635d. Better light at less cost was given by the metallic-filament lamps; but the cost of attending to the lamps had increased

from £502 to £587. The gross income from all sources was £11,559, as compared with £10,031 in the previous year. The cost of generation was £2,490, or ·82d. per unit sold, as against £2,175, or ·74d.; this increase was due to the fact that coal had gone up 3s. per ton. The gross profit was 48·3 per cent., against 46·8 per cent. in the previous year, and 39·3 per cent. in the year before. Next year they expected the accounts to balance exactly.

Gillingham (Kent).—With reference to the recent application by the T.C. for a loan of £5,000 for E.L. purposes, the L.G.B. has written stating that the loan cannot be sanctioned until an official investigation has been made into the whole of the details of the undertaking.

Gloucester.—The electricity accounts show a debit balance of £1,412 at March, 1908; £1,200 now standing to the credit of the water-works account is to be transferred to make up the deficiency.

Grays.—The E.L. profits for the past year were £1,911, and after paying all capital charges there was a surplus of £228.

Grimsby.—The profit on the past year's working of the electrical undertaking was £2,085; £500 was allocated to the relief of the rates.

Govan.—The T.C. is to apply to the Secretary for Scotland for increased borrowing powers (£23,000) for the purpose of meeting the probable expenditure in connection with the electric installation during the next four years; so far the Council has spent £125,186 on the scheme.

Heanor (Notts.).—The U.D.C. recently considered a proposal that expert advice should be obtained as to lighting with electricity a part or the whole of Heanor, Langley Mill and Marlpool. On a vote being taken there were 7 against and 6 in favour; consequently the Committee is dissolved.

Heywood.—The T.C. is purchasing land for electricity works extensions.

Holywood (Co. DOWN).—The committee appointed in connection with the proposed electric lighting of the town has had a consultation with a consulting expert regarding the probable cost. A further report will be made.

Hull.—The question of calling in expert opinion in regard to the electrical undertaking has been raised in the City Council, there being a diversity of opinion as to the success of the undertaking. A sub-station is to be erected in the suburbs at Sculcoates, and it is estimated that the cost of this extension will be £10,000. At the last meeting of the Council, Councillor Costello endeavoured to get the matter referred back, in order that expert opinion might be obtained as to whether the undertaking was a financial success, but his motion was lost. The chairman of the Committee said that they were awaiting the outcome of the new lamps to guide them in the matter of extensions.

Lancaster.—The electricity accounts for the year showed an income of £9,881, as compared with £9,354 last year. The net profit was £1,079, as compared with £370. Lighting and power supply showed fair increases, but tramway supply fell by £198.

Kendal.—The electricity department shows a deficiency of £750 for the year. During the year 14 new customers were added, and three gave up the use of electricity. The output increased by 3,084 units, and the income by £64. Plans of a new refuse destructor and electricity works, to cost £8,000, are under consideration.

Kirkcaldy.—Some time ago a suggestion was made by the Burgh Chamberlain that he should directly collect moneys due for the sale of electricity, and he pointed out that centralisation and not departmentalism was the order of the day. The burgh electrical engineer objected to the change, stating that the commercial work of his department was on an entirely different basis from that dealt with by the Town Chamberlain, inasmuch as it was bound up with a great deal of technical work peculiar to such an undertaking, and required special knowledge gained by experience. He had no hesitation in saying most emphatically that the Chamberlain's suggestion was quite impracticable. The Finance Committee has had a meeting over the matter, but has found it impossible to come to a decision, and the question has, therefore, been left over for a future meeting.

Llandaff.—The D.C. has instructed Messrs. Lewis and Fletcher, electrical engineers, to prepare a complete scheme for the supply of the Whitchurch area.

The D.C. recently considered a letter from Mr. A. Ellis, the Cardiff city electrical engineer, with reference to a supply of electrical energy being afforded from the Cardiff cables to the Llanisien district adjoining the city, where a large number of new houses are being built. The Council favoured the proposal of a supply in bulk, subject to satisfactory terms being arranged.

London.—WOOLWICH.—There are some interesting facts relative to the position of the Borough Council's electricity undertaking in the report of the district auditor (Mr. A. Carson Roberts), on the accounts for the year ended March 31st, 1907, which was presented at a meeting of the Council on June 4th. In connection with the revenue position, it is explained that a loss of £15,744 for the year is shown by the accounts, but the loss shown would have amounted to nearly £17,000 if loans had been raised sufficient to cover the capital expenditure as it was incurred, and the proper share of their redemption charged in the year. The rates will have to provide rather more than the gross earnings of the undertaking, which, apart from the charges for wiring and motors, amounted to £16,824. The rates raised in aid of the undertaking yielded £9,794, but the deficiency brought forward at March 31st, 1906, exceeded this amount by over £1,000, and the accounts show a deficiency at March 31st, 1907, of £16,835. This, however, falls short of the true deficiency at that date, as no account had been taken of the proportion of standing charges which had accrued but not fallen due for payment, bringing the revenue deficiency up to £21,200. In the year just closed he was informed that the rates raised in aid of the undertaking had averaged over 9d. in the £, and had yielded £29,771, a sum sufficient to cover the arrears of deficiency, including accrued proportions, and to provide £8,571 towards the loss on the year's working. Loans have been raised sufficient to cover the capital outlay for the time being. The Electricity Committee has had under consideration (in pursuance of a policy of reducing the cost of generation on the lines suggested by Sir Alexander Kennedy) the desirability of equipping Globe Lane station with coal-handling plant, which it is estimated will reduce the cost of handling the coal by about two-thirds. Tenders are to be invited for plant, in order that the Committee may consider more closely the advantages to be derived.

HAMMERSMITH.—The Electricity Committee has considered a suggested amendment of the conditions of the tender for the supply of coal to the department by deleting the words "Borough Electrical Engineer" in the following clause and inserting in place thereof the words "An Independent Arbitrator selected by the Electricity Committee or Council," viz.:—"In the event of any dispute as to the true intent and meaning of these conditions and specification, or the value, quality, or weight of coal delivered under the contract, the decision of the borough electrical engineer shall be final and binding on all parties concerned." The Committee had made inquiries from other boroughs having electric undertakings, and found that a similar clause was in general use in tenders of this kind, and it did not appear that such a clause made any material difference in the prices quoted. Moreover, it was important that, particularly on questions of value, quality and weight, the records regularly taken at the electricity works of the consignments of coal as they arrived should be accepted by the contractor and the Council. In these circumstances, the Committee was of opinion that the clause should stand. This was agreed to.

ISLINGTON.—The B.C. last week decided that an expenditure of £3,560 was necesary for extending the electric lighting undertaking. The L.C.C. is to be asked for sanction.

BERMONDSEY.—For the year ending March 31st, 1908, the units generated were 2,972,191, as against 2,180,106 for the preceding year. A proposition has been advanced, that, with a view to the better disposal of the clinker from the dust destructor, the paving flag-making plant should be placed under the control of the Electricity Committee. An agreement with the L.C.C. for the supply of electrical energy to the Rotherhithe Tunnel and approaches was approved this week.

CITY.—According to the *Times* the City Board of Guardians decided on Tuesday in favour of electricity as the illuminant for the new workhouse and infirmary at Homerton. "The architect submitted statistics giving the following comparative figures:—Electricity.—Initial cost, £1,000; annual cost of illumination, £150; maintenance, £60; total cost of last two items, £210. Gas.—Initial cost, £289 7s. 9d.; annual cost, £283 16s. 8d.; maintenance, £82 15s.; total annual cost and maintenance, £366 11s. 8d. The total candle-power given for the gas scheme was more than double that of the electricity scheme, but the architect pointed out that the latter had a greater variation in the illuminating power of the lamps, and an 8-C.P. lamp would be used in a position only requiring a small light, whereas in the same position a gas lamp would be using a 60-C.P. illuminant. An amendment that the matter should be referred back to Committee for the advice of an expert was defeated by two votes."

Longton.—The T.C. has decided to extend the mains to the works of Messrs. Adderley, Ltd., Daisy Bank.

Niagara Falls.—A Reuter dispatch from Ottawa says that the report of the Canadian Section of International Waterways Commission advises that all companies developing electric power from the Niagara Falls should be compelled to supply the Canadian demand proportionately, and at reasonable rates, and should only be allowed to export the surplus to the United States. The report further advises that the export should be controlled by the Federal Government.

Rathmines.—The annual accounts of the E.L. department show a loss of £50. There was a large increase in the price of coal and other materials. The receipts from private lighting were £1,000 in excess of those for the previous year, owing to the number of new consumers.

Rochdale.—The T.C. has received from the L.G.B. sanction to a loan of £21,550 for the following purposes:—Excess expenditure, £4,182; new plant, £4,310; mains and house services, £10,666; meters, £480; motors for hire, £1,912. The Board declined to sanction a loan of £325 excess expenditure on motors for hire prior to 1906-7.

Rotherham.—A L.G.B. inquiry was held on June 4th into the application of the T.C. for a loan of £3,500 for electricity purposes, viz., the provision of a 500-KW. direct-current turbo-generator with condensing plant.

St. Annes-on-the-Sea.—The D.C. is about to spend £3,500 on a new main feeder cable.

St. Helens.—Reporting upon the past year's working of the Corporation electricity department, Alderman Beecham (chairman of the Electricity Committee) said that the sales were higher than in any previous year, but, on the other hand, an increased coal bill had led to a larger expenditure. There was a gross profit of £9,527, and after paying interest and sinking fund there remained a surplus of £267. The T.C. proposed to borrow more money for extensions at the power station.

Sunbury.—The B. of T. has informed the U.D.C. that so far as the districts of Sunbury, Feltham, Ashford, Hanworth, Shepperton, and Staines Rural are concerned, the Hampton Wick and District E.L. Order, 1904, has been revoked.

Sheffield.—The Corporation is about to spend a further £20,000 for the purposes of the electricity undertaking; £10,000 is needed for mains and sub-stations, and Neepsend station is to be extended. The town clerk says that the need for improving the service to meet the increased demand is a reminder of the "healthy strenuous competition between electricity and coal gas." Gas at Sheffield is 1s. 4d. per 1000!

Southgate.—Mr. Ruthven Murray, the engineer of the North Metropolitan Electric Power Supply Co., has discussed with a committee of the U.D.C. the financial and other particulars of a suggested scheme for the supply and distribution of electricity within the district. Mr. Murray is to submit an alternative scheme.

Swansea.—The accounts of the electricity department show a net profit on the year's working of £1,460. There is a credit balance of £789 on the undertaking after 7 years' working. A suggestion was recently made by the electrical engineer (Mr. Prusmann) to the Swansea Stone Block and Machine Co. who propose erecting workmen's dwellings in the district on the hollow concrete block plan, that the company should undertake to wire eleven of the houses proposed to be erected, and give the tenants the option of slot meters calibrated for 6d. per unit. He believed that this would give the Committee an excellent opportunity of ascertaining the real value of electrical supply to a small class of property, and his suggestion had been accepted and agreed to.

Taunton.—The Electricity Committee has announced a profit on the year of £281, after paying all charges, and including sums for redemption of loans. £264 has been transferred to the motor purchase fund, and thus all motors have been paid for out of revenue, and their cost transferred to capital account. The Committee is advertising for a supply of coal with the option of taking 1,800 or 2,500 tons.

Tonbridge.—The U.D.C. has decided to supply electricity for illuminating purposes during the cricket week at 3d. per unit.

Wadebridge.—The U.D.C. received a letter from Mr. G. L. Ellis, representing a syndicate, which offered to form a company for installing electric light in the town, provided that no rival scheme should be allowed within 12 months after the completion of the work. Several members thought it would be unwise to let the matter go out of their own hands entirely, and it was suggested that the Council should obtain a provisional order. Consideration of the matter was postponed for a month.

Warrington.—The gross profits on the electricity department for the year were £7,533, and after paying interest and sinking fund there was a balance of £2,213, being £303 less than last year. The income from private consumers increased by £1,345, and that from the tramways supply decreased £310. £2,000 was paid to the relief of the rates last year. The outstanding debts amount to £83,150, and there is a reserve fund of £7,165.

Westhoughton.—The clerk to the Westhoughton D.C. has been instructed to write to the Lancashire Electric Power Co. reminding them that the Council has not renewed its permission to the company to supply power to the Westhoughton Coal and Cannel Co., Ltd., and Messrs. J. Booth & Sons, engineers, which permission expired in August, 1906. In consequence of the serious delay in the transfer of the Council's order to the company, the Council is of opinion that it is equitably entitled to a commission of 2½ per cent. of the gross receipts from the Westhoughton Coal Co. and Messrs. J. Booth & Sons.

Wigan.—The works at Bradford Place are to be extended, and the Pemberton works are to be shut down, as recommended by Mr. Wordingham, the cost being £36,400. Councillor White said that Pemberton had worked at a loss of £2,908 per annum for the last four years.

Wimbledon.—An agreement has been come to with landowners respecting the construction and maintenance by the Council of a weir across the Wandle for the purpose of improving the supply of water for condensing purposes to the electricity works. A Sub-Committee has been appointed to consider the present methods of street lighting, and what improvement, if any, is desirable. The Foster Arc Lamp and Engineering Co., Ltd., wrote asking at what price the Council would supply energy for power purposes to their works on the basis of a minimum consumption of 20,000 units per annum; 1½d. per unit is to be quoted.

Worksop.—The financial statement of the electricity works has just been presented. An application was made for the installation of the electric light at the Criterion Hall, and it was decided to grant it conditionally on the proprietor undertaking to provide a "regulating apparatus" for use with kinematograph exhibitions. The Traders' Association applied for a reduction in the amounts charged for rental of meters, but it was decided not to make any alteration at present, Mr. Thornton observing that the Committee had considered the charges in twelve other towns, and found that, with two exceptions, Worksop consumers were much better off. Having regard to the loss to the rates before the concern "turned the corner," they could not abolish the rents, but in due course the subject should have first consideration. The estimated expenditure for the year on the electric light was £2,500, and the receipts £4,500.

Yarmouth.—After having made profits during the past six years of sums varying from £279 to £3,393, the Corporation electricity works have this year shown a loss of £14. The cost of generation has been £9,146, an increase of £2,500 due entirely to the high price of coal. Distribution cost £763, and management £1,250, the total expenditure being £12,442. The income reached £19,522, an increase of about £1,500. The gross profit of £7,080 is absorbed by paying £2,548 interest, £3,641 sinking fund, £222 income-tax, £178 reserve for special rebates, and £503 discounts, which exceeds by £14 the gross profit. The Chairman (Councillor A. H Johnson) explained that their loans totalled £95,000, and they had paid off £25,000, so the whole undertaking stood charged to the Corporation at £70,000. If it had been a private company they would have shown a handsome profit, and could have paid 5 per cent. They could not help the coal market going up; but for this they would have made a profit of over £2,000.

York.—On 5th inst. a L.G.B. inquiry was held by Mr. H. R. Hooper into an application of the Corporation to borrow £31,000 for electric light purposes. It was reported that the gross revenue for the year ended March 31st was £15,824, an increase of £2,000 on 1907.

TRAMWAY and RAILWAY NOTES.

Aberdeen.—The accounts of the tramways undertaking show that for the year ended May, 1908, the receipts from 16,632,304 passengers, 33,839 luggage tickets, and 12,938 parcel delivery tickets, amounted to £71,079, as compared with £71,779 for the previous year, a decrease of £700. The Royal visit and the University quarter-centenary celebrations accounted for an increase in the receipts of between £1,100 and £1,200. Thus it will be seen that the ordinary traffic of the system has been considerably augmented during the past year. It is anticipated that the expenditure all over will show a substantial reduction, as there is a decrease on wages expended on car repairs since December 1st alone of £274, notwithstanding the fact that the mileage run during the year has increased by 36,436.

Bacup.—Negotiations are approaching completion for the purchase by the Corporation of that portion of the Rossendale Valley Tramway Co.'s system within the Bacup borough boundary.

Belfast.—Trouble has arisen amongst the cleaners at the depôts in consequence of a number of the men being paid off and the remainder having to clean more cars than formerly, as the result of an improved system. The men are working under protest.

Blackpool.—For the past year the tramways income was £53,740, and the expenses were £32,419, the gross profit being £21,322. There was an increase of 9·33 per cent. in passengers, and a decrease of over 1·62 per cent. in car-miles. The reserve fund is £7,788.

Bury.—The T.C. on June 4th decided to give a week's holiday yearly to tramway employés, with pay under certain specified conditions. The cost of this concession will be about £250 a year.

Continental Note.—Turkey.—The work of electrifying the tramways in the town of Salonica has now been completed, and the inauguration of the system is now awaiting the official authorisation.

Derby.—At the last meeting of the T.C. on June 4th, a long discussion took place relative to a revised list of fares and tramways stages recommended by the Tramways Committee. An amendment was proposed by Capt. Newbold referring the matter back on the ground that the proposal was an attempt to fritter away the profits that had been made. There were at least three routes that did not pay now, the receipts being 8d. per mile and the expenses 8½d. Several members spoke in favour of universal penny fares, and Ald. Spriggs, in reply, said he was pleased to report that the electric tramways were paying. They had a reserve fund of £18,000, and all depreciations would be paid for out of revenue. The scheme was adopted with four or five dissentients.

Glasgow.—During the year ended May 31st the Corporation tramway receipts were £907,460, as compared with £887,381 in the preceding year, an increase of £20,079. The passengers carried were 226,487,350, as compared with 224,960,409—an increase of 1,526,941—while the revenue was £905,222, as against £890,992.

Glasgow.—It has been decided by the Tramways Committee, after a close vote, to recommend that the T.C. shall send one member of the Committee and the general manager (Mr. Dalrymple) to represent the T.C. at the International Tramways Conference at Munich.

The Court of Glasgow University has approached the T.C., asking that when the Corporation tramway system is extended along University Avenue a return cable may be laid down as a safeguard against electrical disturbances in the Physical Laboratory of the University. The general manager has been instructed to keep the matter in view, and, if possible, to meet the wishes of the Court, if it be necessary to carry out the suggestion.

The Parliamentary Bills Committee of the Glasgow T.C. recommends that Parliamentary powers should be secured for the construction of certain small extensions to the tramway system—several miles in all.

Leeds.—The extension of the city tramways from Stanningley to Pudsey was opened on June 4th.

Llandudno.—Colonel Yorke last week made a B. of T. inspection of the extension of the electric tramlines from Rhos-on-Sea to Colwyn Bay, owned by the Llandudno Light Railway Co. There is now a service of cars from Llandudno to Station Road, Colwyn Bay.

London.—Through booking has now been introduced between the Central London and the Piccadilly tube railways.

Mexborough.—The following amusing account of the stud traction experiences here appears in the *Sheffield Independent* for June 2nd:—"A 'live' stud on the Mexbro' and Swinton tramway line was yesterday, at Mexbro', responsible for some exciting scenes, a man, two horses, and a dog in turn receiving severe electric shocks. The first to get the current was an employé of the Urban District Council. He was sweeping the road, and the shock sent him bounding into the air. A Great Central Railway horse followed, and was grounded in a trice, but was removed with little damage done. Another horse, belonging to Mr. J. Roper, came next, and this animal received such a severe shock that for some little time it remained lying over the stud helpless. When it was eventually removed it started plunging, and, breaking away, bolted up the street. Fortunately it was caught before doing further harm. A dog next ran on the stud, and was soon helpless, its life being saved by the timely efforts of the Council employé, who used his long-handled brush to good purpose."

Plymouth.—The borough treasurer's annual statement on the working of the tramways for the year ended March 31st last shows an income for the year amounting to £32,932, as against £32,454. Excluding capital charges, the expenditure totalled £24,550, compared with £23,049 in the previous year, leaving a gross profit of £8,382, as against £9,404 in 1906-7. On the net revenue account the gross profit of £8,382 was increased by £75 transferred from the district fund towards interest and sinking-fund charges, and £1,182 the amount received from the Plymouth, Stonehouse, and Devonport Tramways Co., on account of the Union Street Tramways. These items made a total net revenue of £9,639, against £10,662 in the previous year. After payment of interest and sinking fund amounting to £8,867 there was left a net profit on the year's working of £773, compared with £1,353. Of the net profit, £76 was appropriated towards the cost of the Plymouth Corporation Bill of 1903, and the balance of £696 was transferred in aid of rates. On capital account during the year new capital was raised to the amount of £644, which was expended principally on the reconstruction and electrification of the West Hoe section and the purchase of cars.

Rotherham.—The Tramways Committee is to consider the question of establishing a service of motor-omnibuses to run in conjunction with the electric cars.

South Lancashire.—The Lancashire United Tramways have just re-opened their section from the Courthouse, Worsley, to Winton.

Southport.—The annual report of the Corporation electric tramways shows that the total receipts were £18,916, as compared with £18,483 for 1906. The working expenses increased by £168. Out of the gross profits of £7,521, £3,835 was absorbed by interest payments, and £3,269 was put to sinking fund, leaving a net balance on the year's working of £417.

South Shields.—Last week the Mayor (Councillor G. Wylie), in moving the adoption of the Tramway Committee's annual report, said that notwithstanding that towns all over the country had complained of a serious falling-off in traffic, South Shields had, in spite of a bad summer, a credit balance of £11,700, and after paying redemption and other charges, there was a net balance of £2,880 odd.

Walsall.—The Tramways Committee is giving notice to the Wolverhampton and District Electric Tramways, Ltd., to determine on December 31st next, the agreement of February, 1906, between the company and the Corporation, under which the Corporation runs its tramcars over the lines of the company, extending from the Walsall Road Council Schools, Willenhall, unless in the meantime a satisfactory arrangement is come to with the company for the continuance of such running.

The Committee has had under consideration an offer from the South Staffordshire Tramways (Lessee) Co., Ltd., to take from the Corporation electrical energy at 1½d. per unit for the working of the Corporation tramways leased to them, but as a capital expenditure of £800 would have to be incurred, it cannot entertain the proposal.

The tramway employés of the Corporation have petitioned to be paid time-and-a-quarter for Sunday labour; consideration of the petition has been adjourned for a month so that the manager may obtain particulars as to the hours of labour, wages, &c., existing in other towns.

Wolverhampton.—The annual report of the Corporation's tramway undertaking has not yet been officially issued, but it is stated that the total income for the year amounted to £44,432, and the working expenses were £26,461. The net balance was £6,762, and it was disposed of as follows:—To the renewals fund, £4,416; loss on motor-omnibuses, £34; wiping off deficit on account of March 31st, 1907, £1,292; £392 has been carried forward as a general reserve fund, the first in the history of the undertaking. The income shows an increase of over £500, as compared with that of 1907; but the working expenses are this year increased by over £1,500. The motor-omnibus account shows a loss of £234, as against £281 last year. The passengers carried during the year were 9,449,369, as compared with 9,276,023 for 1907. The gross capital expenditure has been £256,521.

Yarmouth.—The annual tramway accounts were presented on Tuesday. The Mayor pointed out that last season was a very bad one, and the traffic decreased greatly. There was a decrease of nearly £1,000 during the summer, and considering that the results were very satisfactory. The total returns were £24,477, and the gross expenditure £16,350, leaving £8,127 gross profit. After paying sinking fund and interest the balance is £1,6 5. Instead of voting this to the relief of the rates, it has been decided to continue the policy of setting aside yearly £1,500 for renewals and carrying the balance forward. A considerable sum was spent during the year in renewals and repairs to the permanent way; £700 a year is paid for rates, and £4,783 was paid to the electricity works for energy.

TELEGRAPH and TELEPHONE NOTES.

Africa.—Telegraph offices have been opened for International correspondence at Ho in German Togoland; at Itsawisis in German South-West Africa; and at Mkumbara in German East Africa.

Tasmania.—The Eastern Extension Cable Co. has issued a writ against the Commonwealth Government for the recovery of £605 damages, in connection with the action of the Government in reducing the cables between the mainland and Tasmania. The case is a test one, as the decision will affect a number of agreements respecting the coastal cables.—*British Australasian.*

Telegraph Conference.—On Friday last the Conference dealt with the question of the pronounceability of code words, and inserted a stipulation to the effect that codes should be submitted to the telegraphic administrations for approval. A board of control, consisting of British, French and German representatives, will be appointed to deal with such codes. Mr. Babington Smith has pointed out that codes not presented for approval, as well as those not approved, will nevertheless remain in force, but each administration will have the right to refuse words contained in them. Thus existing codes will not be interfered with, but it is anticipated that they will gradually be revised.

Press telegrams may in future be written in the language of the journal to which they are addressed. Slight reductions have been effected in the terminal and transit rates, and the rules formulated by the Radio-Telegraphic Convention affecting the land transit of telegrams from or to ships have been embodied in articles.

Telegraphic Interruptions and Repairs:—

Cables.		Interrupted.	Repaired.
Curacao-Coro Curacao-La Guayra Curacao-Maracaibo	Closed	Jan. 12, 1906	
Tarifa-Tangier		Jan. 18, 1904	
Port Arthur-Chifu	(Closed)	Mar. 9, 1904	
Las Palmas—Arrecife		May 18, 1908	
Cayenne-Salinas		May 9, 1908	
Pera-Dardanelles		May 20, 1908	
Dardanelles-Constantinople		June 1, 1903	June 5, 1908
Sierra Leone Accra		May 28, 1908	
Trinidad-Demerara		June 1, 1908	
Cadiz-Tangier		June 3, 1908	
Landlines.			
Puerto-Barrios		Aug. 2, 1902	

Wireless Telegraphy.—Since June 2nd telegrams have been accepted at all telegraph offices in the United Kingdom for transmission to the Midland Railway Co.'s ss. *Londonderry*, which sails between Heysham and Belfast; all such telegrams are sent through the company's wireless station at Heysham, the handing-over offices being Leeds and Skipton. The total charge per word for both inland and wireless service is 1d, with a minimum of 1s. per telegram. The International Regulations as to counting will apply.

CONTRACTS OPEN and CLOSED.

OPEN.

Aberdare.—June 15th. Electrical goods for the Powell Duffryn Steam Coal Co., Ltd., 101, Leadenhall Street, London, E.C. Stores Manager, Aberaman offices, near Aberdare.

Australia.—Perth.—September 7th. 650 telephone wall sets, 150 table sets, various switchboards, other instruments, protectors, &c., for the Postmaster-General's department. Some particulars can be seen at the Electrical Review office.

Melbourne.—July 3rd. One 500-kw. motor-generator, for the electricity supply department. See "Official Notices" May 8th.

Perth.—September 7th. The Postmaster-General requires tenders for one common-battery switchboard, of nine sections in all, together with all associated frames, racks, power plants and parts for Fremantle Exchange.

Adelaide.—July 1st. Telephone and telegraph instruments, switchboards and line material for the Postmaster-General's department. Specification may be seen at Electrical Review office.

Adelaide.—July 7th. The Municipal Tramways Trust requires tenders for supply, delivery and erection of motor equipments and car-wiring.

Adelaide.—July 14th. The Municipal Tramways Trust requires tenders for (1) rotary converters, transformers, boosters, switchboards; (2) equipment of converter stations Nos. 1 and 2; and (3) supply, delivery and erection of storage battery at converter station No. 2.

Belgium.—June 19th. The municipal authorities of Antwerp are inviting tenders for the supply of 1,000 metres of electrical cable necessary for the equipment of the quays at the Lefebvre Dock.

Bradford.—Workhouse main cable. G. M. Crowther, Clerk to the Guardians.

Brussels.—The *Moniteur des Intérêts Matériels* of May 31st notifies that tenders for the following contracts are invited by the Société Nationale des Chemins de Fer Vicinaux, Rue de la Science 14, Brussels:—

June 17th.—Installation of overhead electrical equipment and electric rail connections for the section from Brussels to Grimbergen of the line from Brussels to Humbeek. Price of specifications, 2 fr.; of plans, 24 fr.

July 15th.—Construction of the section from Manbay to Erezée of the local railway Comblain-la-Tour-Manbay-Melreux. Estimated cost, 446,226 fr. (about £17,849). Deposit, 45,000 fr. (about £1,800). Price of specification, 1 fr.

Tenders to the Director-General of the Société. The specifications and plans may be purchased at the above address.—*Board of Trade Journal.*

Burnley.—The Corporation electrical engineer has been requested to obtain tenders for the extensions at the electricity works which have been authorised by the Council.

Dover.—June 15th. Coal for the T.C. Tenders to Town Clerk, Castle House.

Dundee.—June 13th. Electricity meters for the Corporation.

France.—June 18th. The municipal authorities of Paris are inviting tenders for the supply and erection at the Colombes sewerage station, at Gennevilliers, of two sets of centrifugal pumps and three-phase electric motors.

Fulham.—July 2nd. Vertical high-speed engine and 20-kw. steam dynamo (both British-made), for the Guardians. See "Official Notices" to-day.

Galicia.—August 31st. The municipal authorities of Stanislau are inviting tenders for the establishment of a central electric lighting station in the town.

Gillingham.—June 22nd. Coal for the B.C. electricity department. See "Official Notices" June 5th.

Gravesend.—June 27th. Yellow-flame arc lamps, columns, &c., for the electricity department. See "Official Notices" to-day.

Hungary.—The municipal authorities of Nagybecskerek are about to invite tenders for the extension of the central electric lighting station.

L.C.C.—June 23rd. Tramway feeder pillars. See "Official Notices" June 5th.

Malvern.—June 29th. 50-kw. steam alternator, exciter, &c., for the U.D.C. electricity works extensions. See "Official Notices" June 5th.

Manchester.—June 19th. D.C. motors and motor-starters, meters and fuse-boxes, for the Electricity Committee. See "Official Notices" June 5th.

Spain.—June 19th. The municipal authorities of San Feliu de Guixols (province of Gerona) are inviting tenders for the concession for the electric lighting of the town during a period of 10 years. Particulars may be obtained from, and tenders are to be sent to, El Secretario del Ayuntamiento de San Feliu de Guixols (Gerona).

Spain.—July 3rd. The Spanish Post and Telegraph authorities are inviting tenders for the supply and laying of submarine cables between Spain and the Canary Islands and between the islands themselves. Particulars may be obtained from, and tenders are to be sent to, La Direccion General de Correos y Telegrafos, Carretas 10, Madrid.

Spain.—July 31st. The Dirección-General de Obras Publicas invites offers for the construction and working of an electric tramway from La Coruña to Burgo. Tenders should be accompanied by a deposit of 3,658 pesetas (about £128). The adjudication will turn primarily on the reduction in the tariffs which have been approved. An application for this concession has already been filed by the Compañia de Tranvias de la Coruña. A copy of the form of tender and conditions of contract, as well as a statement of the tariffs approved, may be seen at the Commercial Intelligence Branch of the Board of Trade, London.

Stepney.—June 29th. Meters, demand indicators, time switches, and arc lamp carbons, for the electricity department. See "Official Notices" to-day.

Willesden.—June 18th. 300-kw. converting plant for the U.D.C. See "Official Notices" June 5th.

CLOSED.

Burnley.—The Corporation Electricity Committee has accepted the tender of the British Insulated and Helsby Cables, Ltd., for the supply of cable for the Padsham Road and Colne Road extensions.

Croydon.—The Corporation has accepted the tender of Chas. Pullan (Bradford), at £428, for the electric lighting installation for new buildings in connection with the Mental Hospital.

Derby.—The T.C. last week accepted the tender of Messrs. Johnson & Phillips, Ltd., for bitumen cable, at £471.

Dewsbury.—The T.C. has accepted the tender of the Haste Pump Co. for condensing plant, and that of the Midland Engineering Co. for a cooling tower.

Glasgow.—The T.C. Watching and Lighting Committee has accepted the offer of Carl Quitmann for the supply of opalescent electric lamp globes.

The Tramways Sub-Committee on Works and Stores has recommended the acceptance of the following tenders:—

Iron and steel works—turbines foundation, Pinkston.—P. & R. Fleming & Co.
Gear cases.—British Westinghouse Co., and Ateliers de Constructions Electriques de Charleroi.
Lead-covered cable.—National Conduit and Cable Co.
Rubber cables (annual contract).—Craigpark Electric Cable Co. and British Insulated and Helsby Cables, Ltd.
Scrap copper.—Samuel Galbraith.
Scrap lead and brass.—Osborne & Co.

Portsmouth.—The T.C. has accepted the tender of Messrs. W. T. Glover & Co., Ltd., at £858, for 2,500 yards of ·2 sq. in. high-tension cable, and at £172 for 600 yards of ·15 sq. in. cable. Other tenders were received as follows:—

Siemens Bros. & Co., Ltd., £863 and £174.
British Insulated & Helsby Cables, Ltd., £888 and £178.

The tender of Messrs. Buck, Son & Windsor, at £10 9s. 9d., for electric light installation at the new laundry of the Infectious Diseases Hospital, has been accepted by the Council. Other tenders were:—

Southey, Ltd...	..	..	£12	0	0	Grossmith & Co. ..	.. £16	0	0
W. H. Sabine..	..	..	12	8	0	Woodville Electric Co. ..	16	10	0
W. J. Lenton..	..	..	14	15	6	Ashton & Holt ..	.. 19	5	0

Stockport.—The T.C. has accepted the following tenders:

Doulton & Co.—Porcelain troughing, 5d. per yard, and bridges, 11s. per gross.
W. T. Glover & Co.—Cable, £526.
J. & W. S. Briscoe.—Repairs and renewals tramway routes, £599.
Walter Scott, Ltd.—Rails, fishplates and anchors.
Bayliss, Jones & Bayliss, Ltd.—Tie-bars, bolts and lock-nuts.

Swindon.—The T.C. has accepted the following tenders:

W. T. Henley's Telegraph Works Co., Ltd.—Service tee-joint boxes.
Johnson & Phillips, Ltd.—Service tee-joint boxes for troughing.
British Insulated and Helsby Cables, Ltd.—Fuse-boxes.

Tonbridge.—The U.D.C. has accepted the tender of the Western Electric Co. for a year's supply of cable.

London. — BERMONDSEY.—The Electricity Committee has accepted the following tenders:—

Green & Son.—Accessories, and repairs to fuel economiser, £276.
British Electrical Trade Supply & Bitumen Co.—First quality insulating-box compound, £1 10s. 6d. per cwt.

WOOLWICH.—The B.C. has received the following tenders for a motor alternator:—

	Total of tender.	Speed of machine. R.P.M.	Time required for completion.	Efficiency guaranteed. Per cent. Full.	¾	½	¼	Remarks.
Vickers, Son & Maxim	£754	375	3 months	81·0	78·8	73·5	61·4	—
Bruce Peebles & Co.	775	375	4 months	83·5	80·5	75·0	—	P.F. 0·8
Siemens Bros. Dynamo Works, Ltd.	775	375	2½ months	81·0	75·6	68·6	51·6	P.F. 0·8
British Thomson-Houston Co. (accepted)	784	375	3 months	82·3	81·5	77·8	67·6	P.F. 0·8
British Westinghouse Co.	790	375	5 months	83·0	80·0	76·0	62·0	—
General Electric Co.	791	375	3 months	83·5	—	—	—	P.F. 0·8
				83·0	80·0	75·5	62·5	P.F. 1·0
J. H. Holmes & Co.	804	Not exceeding 400	4 months	82·5	79·0	73·0	56·0	—
Brush Electrical Engineering Co. (alternative)	833	500	4 months	83·75	82·0	78·25	68·0	—
Lancashire Dynamo Manufacturing Co.	878	Not stated	2½ months	83·5	82·0	78·5	68·0	—
Dick, Kerr & Co.	912	428	4 months, F.O.R.	—	—	—	—	Incomplete tender
Brush Electrical Engineering Co.	995	375	4 months	83·75	82·0	78·25	68·0	—

Each of these tenders includes a provisional sum of £40 to cover any special expenses which may become necessary during the execution of the contract. P.F. means power factor. The tenders sent in by Messrs. Holmes & Co., the Lancashire Dynamo Co., and Dick, Kerr & Co. do not refer to the wages conditions, the remainder complying in every respect. The Electricity Committee, reporting on the tenders at the last meeting of the Borough Council, said that the most potent factors in the selection of the machine were those of efficiency and time of delivery; and as it was required for long-hour running generally at the lower loads, the higher the efficiency in this particular the greater would be the saving to the Council. A further saving would be effected by quick delivery.

HOLBORN.—The B.C. has received the following tenders for electrical fittings for the new Council offices:—

J. W. Singer & Sons, Ltd.	(accepted)	£369
D. Hulett & Co., Ltd., old brass finish		390
" " bronze finish		452
Hart, Son, Peard & Co., Ltd.		472
Galsworthy, Ltd.		477
Thos. Elsley, Ltd.		543

Wallasey.—The U.D.C. has accepted the tender of Messrs. Heenan & Froude for a refuse destructor, at £3,427.

Walsall.—The Corporation Electricity Committee has accepted the tender of Messrs. Willans & Robinson, Ltd., for a condenser with three-throw air pump, Balcke cooling tower, Templer & Ranoe separator, and Lassen & Hjort purifier, at £2,775.

Worthing.—The T.C. has accepted the tender of the Midland Engineering Co., Ltd., for the supply of condensing plant, &c., at £830.

CONTRACTORS' COLUMN.

[The following information is published in the interests of electrical contractors and others who are seeking for openings for new business. Considerable expense is incurred in the production of this column, and every care is taken to ensure that the information is new and accurate, but it will be understood that in a matter where so many correspondents are engaged, and where the amount of information to be handled is very large, this cannot always be guaranteed. If alleged inaccuracies are reported to the Editors, they will be fully investigated.]

ABERDEEN.—Extension of the Royal Infirmary (£25,000). H. Peterkin chairman of the Board of Directors.

ALDERSHOT.—Houses, Holly Road, for J. Holmes.

ALTRINCHAM.—Proposed hospital at Dunham Massey (£11,400). Altrincham Urban District Council.

AMPTHILL.—Houses, Chalton, for A. Bird; Harlington, for C. Franklin.

ARMAGH.—Renovation of Tontine Buildings for Town Hall and Municipal Offices. J. Caffrey, architect, Armagh.

ASHBOURNE.—Primitive Methodist Manse in Sandybrook Road. J. G. Bagshaw and Son, builders, Buxton.

BANKYFELIN (CARMARTHENSHIRE).—Manse in connection with the Welsh Calvinistic Methodist Church.

BALLYWALTER (Co. DOWN).—Alterations and additions to Ballywalter House for Lord Dunleath. W. J. Fennell, architect, 2, Wellington Place, Belfast.

BARNET.—Iron schoolroom, Stapylton Road, Rev. Francis Spink; road between Normandy and Bedford Avenues. Sparrow & Son, agents, Finchley.

BARNSTAPLE.—Houses, Fort Terrace, for R. Prideaux; Yeo Vale Road for W. Carter.

BATLEY.—Conversion of old post office into two shops for the Batley Co-operative Society.

BECKENHAM.—Alterations to the Technical Institute, Beckenham Road. J. A. Angell, surveyor to the U.D.C., Council offices, Beckenham.

E.L. installation at Alexandra Schools (£225), decided upon by the U.D.C.

BEDFORD.—New church (seat 700). Rev. A. T. Ferguson, pastor of York Street Baptist Church, Bedford.

BELVEDERE (KENT):—Proposed extensive margarine factory for Aarhus Oliefabrick, Ltd.

BERE FERRERS (near TAVISTOCK).—New school. F. J. Young, secretary Education Committee, Exeter.

BIDEFORD.—Extension of the Bideford Grammar School (£600).

BIRKDALE.—Houses, Longford Road, for W. Fraser; Clive Road, for A. Brown; Sandringham Road, Ainsdale, for Rimmer & Lewes; additions to Smedley's Hydro, Trafalgar Road.

BIRKENHEAD.—Shops in Land Street. Birkenhead, Co-operative Society.

BIRSTALL.—New Sunday Schools, Howden Clough. Walter Hanstock & Son, architects, Batley.

BLACKBURN.—Structural alterations, &c., at St. John the Evangelist Church.

BOURNEMOUTH.—Houses, Fitzharris Avenue, for G. Wilcox; Maxwell Road, for A. Barnes; Beaufort and Fenton Roads, for Mr. Stewart; Southwood Avenue, for H. Short; Birbank Road, for C. T. Rhodes; Fenton Road, for H. Hook; Marine Road, for J. Edwards; Edge Hill Road, for H. Elliott; Heron Court Road, for J. Belbin; four shops, Southbourne Grove, for S. Pellew.

BRIDLINGTON.—New School for the T.C. J. Earnshaw, architect, Wellington Road, Bridlington.

School and Teachers' house at Boynton for the East Riding of Yorks C.C. County Building Surveyor, County Hall, Beverley.

BRISTOL.—E.H.T. Sub-station, Pembroke Road, Shirehampton, for the T.C. H. Faraday Proctor, city electrical engineer.

Council School at Sefton Park for the T.C. W. V. & A. R. Gough, architects, 24, Bridge Street, Bristol.

BROMLEY.—County School, Nightingale Lane. Architect, Kent Education Committee.

BROMSGROVE.—Bathrooms at the Workhouse and Infirmary. G. H. Gadd, architect, Town Hall Chambers, Bromsgrove.

BRYNNA (near LLANHARRAN, GLAM.).—Thirty houses for the Brynna Building Committee. J. T. Jenkins, architect, Porth, Rhondda.

BUCKHAVEN (FIFE).—Proposed slaughter house (£1,500). Burgh Surveyor, Buckhaven.

BURGESS HILL (SUSSEX).—Enlargement and improvement of the Burgess Hill, London Road, Public Elementary School. F. J. Wood, county surveyor, County Hall, Lewes.

BURSLEM.—Proposed Central School. Burslem Education Committee.

BURY (LANCS.).—Proposed extensions to workhouse (£12,000) for the Bury Board of Guardians; Municipal Artisans' Dwellings in Bolton Road, Borough Engineer; Elementary Council School to be built at Elton, Bury, for the Bury Education Committee.

CANTERBURY.—Additions to Wilton Lodge, New Dover Road, for H. R. Latter.

CARDIFF (SENGHENYDD).—Houses (57) for the Universal Building Society and R. T. Rees, Maesyffynon, Aberdare. T. E. Richards, architect, Pontypridd.

(CANTON).—Parochial Hall and Mission Room (£1,800). Veall and Sant, architects, 5, Arcade Chambers, High Street, Cardiff.

CARSHALTON.—Sixteen houses, Stanley Road, A. B. Cook, builder, Cranley House, Wallington; two houses, The Beeches, Priest & Co., builders, 54, Lordship Lane, East Dulwich.

CASTLEFORD (YORKS.).—Houses, Smawthorne Avenue, for Dr. Hillman. Arthur Hartley, architect, County Chambers, Castleford.

CHEADLE (CHESHIRE).—Houses, Acre Lane and Moss Lane, Cheadle Hulme, for J. H. Clibran; Moss Lane, for Messrs. Woodhead; Victoria Avenue, for Mr. Westcott; Hill Top Avenue, for W. Rhodes.

CLACTON-ON-SEA.—Houses, Page Road, for Mrs. Newman; Holland Road, for J. C. Burchardt; Nelson Road, for J. D. Rawlings, jun.

CLEATOR.—Residence for Wm. Colebank. Pickering & Crompton, architects, Whitehaven.

COLEFORD.—Houses on Tufthorn Road, Milkwall. James & Morgan, architects, Charles Street, Cardiff.

CONWAY.—Proposed chapel in Baden-Powell Street, Llandudno Junction. Trustees of the Caersalem C.M. Chapel, Llandudno Junction.

COVENTRY.—Houses, Stanley Road, for T. Randle; Kensington Road, for C. E. Needham; Walsgrave Road, for W. Wincott; Northfield Road, for J. Jervis; Newnham Road and Swan Lane, for the executors of Geo. Storer; Westwood Road East, for W. Higgins; Holyhead Road, for T. Hancox; Dean Street, for W. Vaughan; Wright Street, for W. Haywood; 70 houses for the Corporation, J. E. Swindlehurst, city engineer.

CREWE.—Eighteen houses off Middlewich Street, W. Micklewright; six houses in Denver Street, Councillor J. Jones; additional houses in Gainsborough Road, Mrs. Wade; five houses in Sefton Avenue, O. Jones.

CRICK (NORTHANTS).—Alterations and additions to the Church of England Schools. J. T. Blackwell, architect, 53, High Street, Kettering.

CROWBOROUGH (SUSSEX).—Enlargement of the White Hill Public Elementary School. F. J. Wood, county surveyor, County Hall, Lewes.

CROYDON.—Nine houses, E. Bates, architect, 2, Imperial Buildings, Croydon; 10 houses, Broad Green Avenue, C. A. Sedgewick, builder, Frant Road, Thornton Heath; 12 houses, Blackhorse Lane, G. Nixon, surveyor, 11, Buckleigh Road, S.W.; additions to the Mental Hospital for the T.C., lit by electricity (£21,143), B. E. Nightingale, builder, Albert Works, Albert Embankment, London, S.E.

CYMMERGYR (CARDIGANSHIRE).—Welsh Calvinistic Methodist Chapel.

DERBY.—Extensions and improvements at Sewage Disposal Works (£25,000). Borough Engineer.

DEWSBURY.—Reconstruction of business premises for Senior & McCann, Bradford Road; houses, Leeds and Elland Road, for Isaac Nelson and W. Nelson.

DONCASTER.—Shop premises, junction of Bower's Fold and Silver Street, for the T.C. Borough Surveyor.

DOUNE.—New Temperance Hotel. J. Innes & Sons, builders, Doune.

DUBLIN.—Technical School in Bolton Street. City Architect, Municipal Buildings, Cork Hill, Dublin.

DUNFERMLINE.—Alterations on property for Mrs. Kelt, Bridge Street, Dunfermline.

DURHAM.—Electricity Sub-station, for the County of Durham Electrical Power Distribution Co., Ltd.

DURHAM.—House, High Wood, for Mr. Heatley; additions to St. Giles's School.

EMSWORTH.—Proposed Council School. W. J. Taylor, County Surveyor, The Castle, Winchester.

EVESHAM.—Proposed new Schools for Worcestershire C.C. (£3,200).

EXMOUTH.—E.L. installation in the Exmouth Wesleyan Church.

FALMOUTH.—Rebuilding Seven Stars Hotel, Flushing, for Messrs. W. & E. C. Carne, Falmouth.

FARNWORTH (near Bolton).—Seven houses and shops in Bradford Street, and four houses and shops in Buckley Lane, Farnworth-with-Kearsley Co-operative Society; three houses in Buckley Lane, E. Almond; block of houses in Brookhouse, Farnworth, J. T. Walker, builder, Walkden.

FATFIELD (near Penshaw Station).—Thirty-three houses for the Lambton Collieries, Ltd. Architect, Philadelphia Lime Depôt, Co. Durham.

FILEY.—Masonic Temple in Rutland Street. W. B. Clarkson, architect, Bridlington.

FLEET (Hants.).—Houses for Miss Ventham, Mr. Wright, and Mr. Morrell; warehouse for Mr. Pearson; motor works for Mr. Wilson.

FOLKESTONE.—Two large houses in Grimston Gardens, South. W. White, Cherdon Place, builder; A. Bromley, architect, Cherdon Place.

Development of two new streets, Broadfield and Ravenlea Roads, for W. Smith, H. Videan, architect; five houses in St. Hilda Road, for C. Rootes, owner and architect.

FROME.—Additions to Butler & Tanner's factory.

GATESHEAD.—Conversion of technical institute, West Street, into banking premises.

GILLINGHAM (Kent).—Bungalow residence, Hempstead, for Mr. Clifford; houses, Gillingham Road, for Mr. Crawley, Mr. Randall, architect, High Street, Chatham; Borough Road, for W. Croneen; additions to shops, Canterbury Street, for Mr. King.

GLAMORGANSHIRE.—New infant school at Pencoed; new elementary school at Abertridwr; improvements at Rhydygwern School, near Machen; alterations and additions to Neath Road School, Briton Ferry; alterations and additions to Neath County School. W. E. R. Allen, deputy clerk to the Glamorgan County Council, Cardiff.

GLASGOW.—Extension of St. Aloysius Catholic College, Scott Street.

GODALMING.—Church of England schools in Moss Lane.

GOODMAYES (Essex).—Proposed new Congregational Church. Rev. D. Bull, minister.

GRANTHAM.—Houses, Alexandra Road, for Walker Bros.; Stamford Street, for John Skipworth; offices and stores, Dysart Road, for Melbourn Bros.

GUILDFORD.—Proposed mixed school for Education Committee. F. S. Tosswill, secretary.

HARLECH (North Wales).—Public library.

HAROLD WOOD.—Alterations, &c., to the Grange for the West Ham Council. J. G. Morley, borough engineer, Town Hall, West Ham, E.

HARROGATE.—Additions to 2, Beech Grove. T. E. Marshall, architects, City Bank Chambers, Harrogate.

HARROW.—Eight houses, Dorset Road, J. Emes, architect, 151, Ebury Street, S.W.; proposed offices in Northolt Road, for Harrow and Stanmore Gas Co.

HEXHAM.—P.M. Church in Battle Hill and Beaumont Street. Cackett and Burns Dick, architects, Newcastle; J. Civil, contractor, Hexham.

HORNSEA (near Hull).—Houses, Clifford Street, for J. O. Pickering.

HOUGHTON-LE-SPRING (Co. Durham).—Houses and shops, for Mrs. Gilroy, Mr. Marley, Mr. Bruce, Newbottle Street; Mr. Brown, Wheeler Street, and Messrs. Morton.

HULL.—Shops for the Corporation; proposed Art Gallery, &c., for the T.C. (£6,000).

ILFORD.—Houses (97) in Vaughan Gardens, for A. Beauclerk (L. Verlyck, architect); Sylvan Road, for Miss Hammock (F. G. Faunch, architect, 76, Cranbrook Road, Ilford); additions to works, Roden Street, for Ilford, Ltd., photographic plate, &c., manufacturers; place of amusement, junction of Ilford Lane and the Broadway, for Variety Enterprises, Ltd. (£20,000); stable for South Essex Laundry Co., Ltd., Roden Street.

KINGSTON-UPON-HULL.—Extension of the Town Hall (second portion). Russell & Cooper, architects, 11, Gray's Inn Square, London, W.C.

KIRKBY-IN-ASHFIELD (Notts.).—Houses, Oxford Street, for Coleman and Blackburn; Oxford Street, for J. Stowe; Diamond Avenue, for T. E. Banks.

KIRKHAM and WESHAM.—New Council schools now decided upon. Lancs. County Education Committee.

KIRTON SKELDYKE (Lincs.).—Chapel, schools, class-room, &c. W. Greenfield, architect, Boston.

LANARK.—Villa in Garngad Road, Millerston, J. Pinkerton, Hogganfield; villa in Cumbernauld Road, Riddrie. Riddrie Park Building Co.

LANCASTER.—Alteration of the Baptist Church (£600), Rev. S. J. Robins, pastor; houses at Ellel for Mr. Ingham; additions to residence at Hest Bank, for Rev. W. H. Towers.

LEEDS.—Firemen's dwellings in Park Street for the Corporation (£7,048).

(Tingley).—Wesleyan Methodist Sunday Schools (£1,400).

(Stanningley).—Primitive Methodist Sunday Schools.

LICHFIELD.—Proposed Church Day school (£2,400).

LINCOLN.—Alteration to place of worship in Mint Street. Rev. F. E. Miller, Thomas Cooper Memorial Church, Lincoln.

New church at Owersby (£500).

LINTHWAITE (Yorks.).—Houses, Radcliffe Road, for Sam Avison; extensions to Burdett Mills, for Armitage Bros.

LITTLE HULTON.—Three houses at Greenheyes. J. Bridge, builder, Walkden.

LLANDAFF.—Two houses in Palace Road, W. Thomas, builder; three houses in Watson Road, Llandaff, E. Lewis, builder, Llandaff North.

(North).—Four houses, Copplestone Road, Llandaff (North). D. C. James, builder.

LLANISHEN.—New Baptist Chapel.

LONDON (Golder's Green, N.W.).—Development of 60 acres of land for building. Hon. Wm. H. Appleton.

(Barnes, S.W.).—Shops. F. W. Dunkley, agent, Church Road, Barnes.

(Kingsway, W.C.).—Buildings. Jas. Smith & Sons, builders, South Norwood.

(Ealing, W.).—Proposed Welsh Mission Hall. T. J. Evans, architect, Fulham, S.W.

(East Ham, E.).—School buildings. R. L. Curtis, architect, 11-12, Finsbury Square, E.C.

(Barnes, S.W.).—Villas. Chas. Ellis & Co., builders, 174, Upper Richmond Road, East Sheen, S.W.

(Broad Street, W.C.).—Shops, &c. F. G. Minter, builder, Putney.

(Shoe Lane, E.C.).—Rebuilding Black Dog public house. Rice and Son, builders, Stockwell Road, S.W.

Barbican, E.C.).—Warehouses, &c. Patman & Fotheringham, builders, Liverpool Road, N.

LONDON (Kilburn, N.W.).—Empire Theatre of Varieties. T. H. Kingerlee and Sons, builders, Oxford.

(Barnes, S.W.).—Development of building estate at Castlenau. M. Thacker & Co., contractors, 53, Victoria Street, S.W.

(Kingsway, W.C.).—Buildings. Barlow & Roberts, builders, 14, Red Cross Street, S.E.

(Wimbledon).—Shop and showroom. Whitehead Bros., builders, 21, Wimbledon Hill Road.

(Wimbledon Common).—Alterations and additions to building. R. A. Hinds, architect, Wood Nook, Wimbledon Hill.

(Wimbledon).—Conversion of premises into shops. Whitehead Bros., builders, 21, Wimbledon Hill Road.

(Wimbledon North).—Enlargement of cottage hospital (£2,500). A. Steele Sheldon, Town Clerk, Wimbledon.

(Wimbledon Park).—Thirty-three houses, The Crescent. Ryan and Penfold, agents, Wimbledon Park.

(Wimbledon).—Thirty-five houses, Melrose Avenue. C. Barwell, The Elms, Morden, Wimbledon.

(Merton).—Laundry in High Street. Hooker & Webb, 4, High Street, Croydon.

(Wimbledon).—New church and parish room. T. G. Jackson, architect, 14, Buckingham Street, Strand, W.C.

(Wimbledon).—Shops and flats. Thompson & Pomeroy, architects, Hill Road, Wimbledon.

(West Ealing, W.).—Works at Perivale, for the Purex Lead Co.

(Finchley, N.).—Ten houses and shop, Regent's Park Road; four houses, Great North Road. C. F. Day, builder, 21, Regent's Parade, Finchley.

(Finchley, N.).—Two houses, Arden Road. C. W. Scott, builder, Church End Station, N.W.

(Southgate, N.).—Proposed additional office accommodation. C. G. Lawson, Urban District Surveyor.

(Finchley, N.).—Additions to Wesleyan Chapel and new Sunday School.

(Southgate, N.).—Six houses. W. J. Edwards, Langdale, Woodside Grove, Finchley.

LOSTOCK (near Bolton).—Important colliery developments. H. S. Higginbottom, coal merchant, Liverpool.

LUTON.—Railway Mission Hall.—A. Cole, builder, High Town Road, Luton.

MALVERN.—Additions to The Abbey, Malvern Wells, for Berwick, Lechmere and Co.; extensions to Malvern College Chapel, T. Broad, Ltd., builders, Malvern; houses, Newton Road, for W. and G. Birchley.

MANCHESTER.—Electric car depôt and buildings, for the T.C. J. M. M'Elroy, general manager, tramways department, 55, Piccadilly, Manchester.

MANSFIELD WOODHOUSE.—Proposed police station for the U.D.C.; houses (32), Leeming Lane and Old Mill Lane, for E. Stainforth.

MATLOCK.—Joint isolation hospital contemplated. Matlock District Council.

MERTHYR TYDFIL.—Seven additional classrooms, cookery rooms, &c., at Twynrodyn School. E. Stephens, clerk to Education Committee, Merthyr Tydfil.

MIDDLESBROUGH.—Proposed block of business premises for W. Whiteley, Ltd., Universal Providers, London.

MIRFIELD (Yorks.).—Additions to the House of Resurrection. J. W. Blackburn & Son, builders, Stocks Bank.

MORRISTON (Glam.).—Parish Hall. C. S. Thomas, architect, Wind Street, Swansea.

NAIRN.—Store and offices at the Shambles. D. Munro, Burgh surveyor, Albert Street, Nairn.

NEWARK.—Alterations to the Vicarage, Appletongate. Sheppard & Lockton, architects, Newark.

NEWCASTLE-ON-TYNE.—Two semi-detached villas in Osborne Road; eight houses in St. Margaret's Road; two villas in Holme Avenue, Walker; two villas in Michell Avenue; four semi-detached villas in Fern Avenue.

Extension of premises in Groat Market for entertainment purposes (seat 2,000).

NEW DEER (Aberdeen).—Alterations and additions to The Cottage, Allathan, New Deer. G. Bennett Mitchell, architect, Union Street, Aberdeen.

NEWPORT (Mon.)—New Y.W.C.A. Lecture Hall.

NEW ROSS (Co. Wexford).—New Technical School in contemplation.

NORBURY.—Buildings. L. Whitehead & Co., Ltd., builders, Portland Place North, South Lambeth.

NORDEN (near Rochdale).—Houses, Tenterfield, for J. H. Heywood & Sons Broadhalgh, for S. J. Lee.

NOTTINGHAM.—New Vicarage for the parish of St. Luke's.

OKEHAMPTON.—New School. E. H. Harbottle, architect, County Chambers, Queen Street, Exeter.

OLDBURY.—School at Langley for the District Council.

OLDHAM.—Thirty-eight houses, Hillside Avenue, for the Equitable Co-operative Society.

Extensions to the Workhouse, General Infirmaries and Nurses' Home, for the B.G. T. Taylor, architect, 29, Queen Street, Oldham.

PENRIKYBER (Glam.).—Three officials' houses for the Penrikyber Colliery Co., Ltd. Geo. Kenshole, architect, Bargoed.

PERTH.—New school in Dunkeld Road, for 1,080 pupils. G. P. K. Young, architect, Perth.

Extension of General Accident Assurance Corporation Buildings. G. P. K. Young, architect, Perth.

Shops, houses, &c., at York Place, for Co-operative Society. McLaren and Mackay, architects, Perth.

Additions and improvements at Logie House for Earl of Mansfield. P. Keay, builder, Methven by Perth.

New session house for St. John's Churches. Burgh surveyor, Perth.

PLYMSTOCK (near Plymouth).—New school. County architect.

PORTSMOUTH.—Reconstruction of business premises, Palmerston Road, for Handley, Ltd.

QUAKER'S YARD (Glam.).—20 houses on the Woodlands Estate. Wm. Dowdeswell, architect, Treharris.

QUORN.—Residence for Rev. Neville Colbrooke. T. Cooke, architect, Belgrave, Leicestershire.

RADYR.—Villa on main road. J. Jenkins, builder.

RAWTENSTALL.—Extension of mill premises for D. Whitehead & Sons.

REDNAL (Birmingham).—Public reading room. Chairman of the Public Libraries Committee.

RETFORD.—Houses, Portland Road, for R. Brown; London Road, for M. Fletcher; Storcroft Road, for H. Ostler; additions to 108, Carolgate, for T. Hopkinson.

RUGBY.—Four houses in Newland Street, New Bilton, for Mr. Head.

RUNCORN.—Additions to Argyll Lodge, Monghland Lane, for A. Timmins; houses, Picton Avenue, for H. H. Posnett; Greenway Road, for E. Pearson; Victoria Road, for J. K. Littler; Cawley Street, for T. J. Kirkham.

RUTHIN (Llanbedr).—Renovation of the C.M. Chapel and Chapel House. T. Parry, Llys Aled, Colwyn Bay.

ST. ALBANS.—Houses, Blandford Road, for H. J. Skelton; Tyttenhanger Green, for C. Morris.

New factory for the manufacture of arc lamps at The Camp. Arc Lamp Co., Ltd, owners.

ST. ANNES-ON-THE-SEA.—Billiard room and motor-house, for A. E. Edwards, Bungalow, Headroomgate Road; motor-house for Gordon Boddington, 6, Beach Road.

ST. HELENS.—Important extensions to Providence Hospital (£6,000). J. A. Baron, architect, 7, Cotham Street, St. Helens.

SANDRIDGE (Herts).—Vicarage and stables for Rev. H. R. Anson.

SELLY OAK (Birmingham).—School in Pershore Road, Selly Park, for the King's Norton and Northfield U.D.C. Education Committee. J. F. Moore, secretary to the Committee, King's Norton.

SHEERNESS.—House and shop, Unity Street. Amos & Foad, builders, Whitstable.

SHEFFIELD.—Carriage storing shed for the Midland Railway Co. A. L. Charles, secretary to the company, Derby.

SKIRBECK (Boston).—Almshouses in Freiston Road, Skirbeck. Trustees of the Horton Almshouses Charity.

SMETHWICK.—Proposed new technical school in Crockett's Lane for the Education Committee.

SOUTHALL (Middlesex).—Hotel at Greenford Park, for Sich & Co.

SOUTHAMPTON.—Schools for the T.C. (£3,580). H. Stevens & Co., builders, Millbank Works, Southampton.

SPENNYMOOR (Co. Durham).—House, Durham Road, for W. Pattinson.

STANDISH.—House in Church Street, R. Baxter; four villas near Boar's Head, J. Pennington; and block of cottages, Collingwood Street, for H. Baxter.

STIRLING.—Tenements in Weaver Row, St. Ninians, for J. & J. Somerville; rebuilding and extending licensed premises in Upper Craigs for J. Gillespie.

SWANSEA.—Stock room premises, Hotel Cameron, Ltd. Chas. J. Ruthen, architect, Swansea.

SWINDON.—Houses, Plymouth Street, J. George, builder, 169, Victoria Road, Swindon; York Road, for Mrs. J. E. Bell.

TADCASTER.—New Church at Earby, near Craven. Bromet & Thorman, architects, Tadcaster.

TANDRAGEE (Co. Armagh).—New Methodist Manse.

TAUNTON.—New shop in Albermarle Terrace. A. Fouracre, Elmcroft, Taunton.

Two houses, Greenway Road. Mr. Lowe, Staplegrove Road.

TENBY.—Palace Hotel on the North Cliff.

TENBURY.—Proposed Parish Hall. R. W. Jarvis, architect, Tenbury.

TONBRIDGE.—Detached residence, Goldsmid Road, for C. J. Fowler, Westwood, Goldsmith Road; four pairs of villas, Lionel Road, W. Groombridge, builder, 6, Waterloo Road, Tonbridge.

TRANENT (Haddingtonshire).—Alterations to the Tranent School. Lyle and Constable, architects, 3, Hill Street, Edinburgh.

TURRIFF.—Farm steading. Hill of Cotburn. W. L. Duncan, architect, Turriff.

TWICKENHAM.—Girls' Secondary School and Technical Institute for Middlesex C.C. (£18,000). H. G. Crothall, architect to the Education Committee.

TYLDESLEY (Lancs.).—Library for the U.D.C. W. J. Matthews, clerk, Council Offices, Tyldesley.

WADEBRIDGE (Cornwall).—Houses, H. Symons, builder, Glendower, Wadebridge; house, for Mr. Fishwick, W. T. M. Mear, architect, Wadebridge.

WALKDEN.—Public offices, J. Howard, surveyor, Council Offices, Walkden; shop in Hodge Road, Walkden Co-operative Society; alterations to Oak Gate House, Old Clough Lane, Mrs. T. Cooke.

WALLINGTON (Surrey).—New R.C. Church and Presbytery. Very Rev. Canon Cafferata, Rector, Our Lady's Church, Sutton.

WALMER (Kent).—House and shop, North Barrack Road, for J. C. Mackins.

WANTAGE.—Two pairs of villas, Priory Road, for Mrs. J. Trow.

WASHINGTON (Co. Durham).—Fifty houses for Durham C.C. (£12,000).

WEALDSTONE.—Shop and workshop, High Street, for Freeman, Hardy and Willis, boot manufacturers, Newington Butts, S.E.

WHITCHURCH (near Cardiff).—Two houses at Belle Vue Crescent; W. Symonds, builder, Whitchurch. Six houses and four houses and shops, at Evansfield Road; D. C. James, builder, Whitchurch. Six houses, at Tynypare; F. Thomas, builder. Two houses, Kelston Road; H. Gunnmar, builder. Two houses, Glanynout Road; Thos. Evans, builder. Two houses, The Parade; J. R. & D. Evans, builders. Five villas, Wingfield Road; J. E. Evans, builder.

WIGAN.—Proposed destructor at Corporation electricity works.

WORSLEY.—Five houses in Manchester Road, for T. Lowe; houses on Worsley Green, for the Earl of Ellesmere.

WOODSEATS (Sheffield).—Church for the Methodist New Connexion (£3,000).

WREXHAM.—Temperance Institute. Lavender & Edwards, architects, 56A, Hope Street, Wrexham.

FORTHCOMING EVENTS.

To-day's Events (Friday, June 12th).—At 8 p.m. At the Royal College of Science, South Kensington, S.W. Physical Society. Special general meeting, followed by papers on "Experiments on a Directive System of Wireless Telegraphy," by Messrs. Bellini and Tosi; "The Resistance of a Conductor of Uniform Thickness whose Breadth Suddenly Changes, and on the Shapes of the Stream Lines." by Prof. Lees; "The Self-Inductance of Two Parallel Wires," by Dr. Nicholson; "Homogeneous Secondary Radiation," by Dr. Barkla and Mr. Sadler.

Fallen Wire Claim Settled.—During the gale of February 22nd last Mr. C. Allen, of Hemsby, near Yarmouth, while driving home, had his horse killed, and was, with his wife, injured by reason of a telephone wire being blown across a live trolley wire in connection with the Corporation's electric tramways. The town clerk was served with a writ at the suit of Mr. Allen, and the Corporation have settled the action by the payment of the sum of £86 to Mr. Allen's solicitor.

NOTES.

Electric Light in Schools.—In the course of a report contained in an appendix of the report of the Medical Officer (Education) of the L.C.C., the subjoined reference is made to the lighting of schools by electricity:—

Handiness, simplicity and ease of distributing points of light, complete absence of shadows below the lamp, the possibility of perfect reflection, healthiness in freedom from consumption of air and production of fumes, and noiselessness, make lighting by the electric glow lamp the most perfect means now available for school use, the only drawback being its present greater cost—namely, about 1·7 times that of gas.

Two sorts of opal shades are in use in the schools; one subtends 110° in the sides, and has a vertical depth of 3½ in. This shade does not cover the lamp, and the incandescent filament is exposed to the teachers' eyes. The other shade has sides subtending an angle of 80°, and with a vertical depth of 5 in.; this shade completely screens the lamp from the teacher, and is the one to be preferred for class-room purposes, as the light below is also increased by one-third. These lamps throw an image of the filament. If a sheet of white paper be held under the lamp at a distance of 1 yard four bright stars, each with a bright tail outwards, will be seen marking the corners of a square of 1 ft. side. At the distance of 2 yards the separation of the points is 2 ft. The better the reflector over the lamp, the less noticeable are these lines. Ground glass bulbs obscure the light completely, but frosting the glass reduces the illumination by 25 to 30 per cent.

The only suggestion to be made as to bulbs is that these should be as large as possible, and the filament twisted in as long a loop as possible. Mr. Harman has also examined the "tantalum" and the "Nernst" lamps. The former appears very good, but the latter is unsuitable for school rooms.

The distribution of the lamps should be as follows:—Beginning from the left hand of the children's portion of the class room, a lamp should be hung over the centre of the first dual desk and from there across the breadth of the room at distances of not less than 6 ft. and not more than 9 ft. for 16-c.p. lamps with 90° shades. With gas the fewest possible number of burners is desirable, for the more burners the worse the atmosphere; but with electricity the points of light may with advantage be more generously disposed, and a cross room spacing of 6 ft. may be uniformly arranged. A second row of lamps should be hung in the same relation over the third row of desks. The lamps, as usually hung, err in being hung too far back—for instance, over a back row of desks, with the idea of their illuminating the desks in front, which they, however, fail to do when the children are present in their seats. The use of a front row of lamps with tilting shades, to light the blackboards, in the teacher's section of the room, or desks in the children's portion, fails to serve both purposes in practice. It would be better to use a lamp to illuminate the desk and blackboard and completely shaded from the children's portion of the room. The most common complaint in the electrically lighted schools is want of light owing to low pressure of the supply. Sudden and total failure also occurs occasionally. In installing electric light, it should be used in class-rooms only. Staircases and passages should be lighted with gas—naked jets, with wire frames.

In addition to these ordinary means of illumination used in the schools, there are several other methods used in America, or on the Continent. The inverted gas burners, with incandescence, recently much used in shop lighting, although they throw the light downwards, have drawbacks for school use. With an inverted Bunsen burner the combustion is imperfect, and noxious odours, fumes escape to much greater extent than with the erect burners. They are also very susceptible to variations in pressure, and at times give very poor light. They easily get out of order and require a great deal of attention. In some non-provided schools they are found in very bad condition.

Refraction and reflection in certain forms of shades have been much recommended in America for school use. The prismatic and the Holophane globes were examined. The prismatic globe has the outer surface of a glass bowl moulded into a series of prisms running round the bowl, and so placed as to throw light downwards. It is very effective, especially when a flattened opal shade closes the mouth of the bowl. The combination is costly and heavy, and an equally good effect can be obtained with the 90° shade globe.

Indirect illumination by reflection is now a very favourite method in the newer German schools. By this method, powerful lights, usually arc lamps, are hung from the ceiling, with metal reflectors below them. The light is thrown on to the white ceiling or to special reflectors and reflected as a delightfully uniform and soft radiance over the whole room. The effect is not unlike daylight of modified brilliance, and it is most successfully employed in shops and showrooms, where the deep shadows of direct light would be destructive of the general effects of mass and colour required to be shown. It is, however, not good where continuous and detailed work at a desk is required. The system was adopted in the new Anatomical Laboratories of Cambridge University, but had to be superseded by direct glow-lamp illumination.

Canals.—Last week the members of the British Royal Commission on Canals spent some days in Holland investigating the canal systems of that country.

(Continued on page 996.)

ELECTRIC TRACTION ON THE MIDLAND RAILWAY.

SOME DETAILS OF THE SINGLE-PHASE SECTION BETWEEN HEYSHAM, MORECAMBE AND LANCASTER.

For a good many months past the British railway world has been expectantly waiting for some account of the work carried out by the Midland Railway Co., in electrifying the section of their route between Heysham, Morecambe and Lancaster.

This section of double-tracked route, some ten miles in length, has been reconstructed for electric traction on the overhead system, using single-phase alternating current at 6,600 volts pressure and 25 cycles, and is the first single-phase line so far put into operation in this country.

It may here be mentioned that the two contact or trolley wires serve as feeders for the route, and are energised from the Heysham Power Station of the company, which, as originally designed, was described and illustrated in the Electrical Review of November 4th, 1904.

The overhead construction has been designed and carried out under the direction of Mr. W. B. Worthington, the chief engineer of the Midland Railway Co.; by Mr. J. Sayers, the telegraph engineer of the company; and Mr. Argyle, the Northern divisional engineer.

It is similar as regards the type of suspension to that adopted for the electrification of the Hamburg-Altona Railway, the chief difference between them being the new type of suspension of the catenary wire, which is the design of Mr. Sayers.

The route electrified, which is shown below, comprises the double roads between Heysham and Morecambe; Morecambe and Lancaster Green Ayre, and the single line from Lancaster Green Ayre to Lancaster Castle Station; the total length of single track is about 21 miles. The line passes under a large number of over-bridges, mostly of the arched shape, and the clearance of these bridges has been a matter of considerable interest.

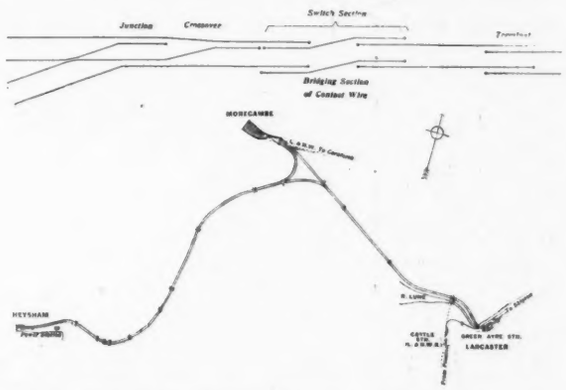


Fig. 1.—Plan of Electrified Routes, and Diagram showing Wiring at Junctions and Cross-overs.

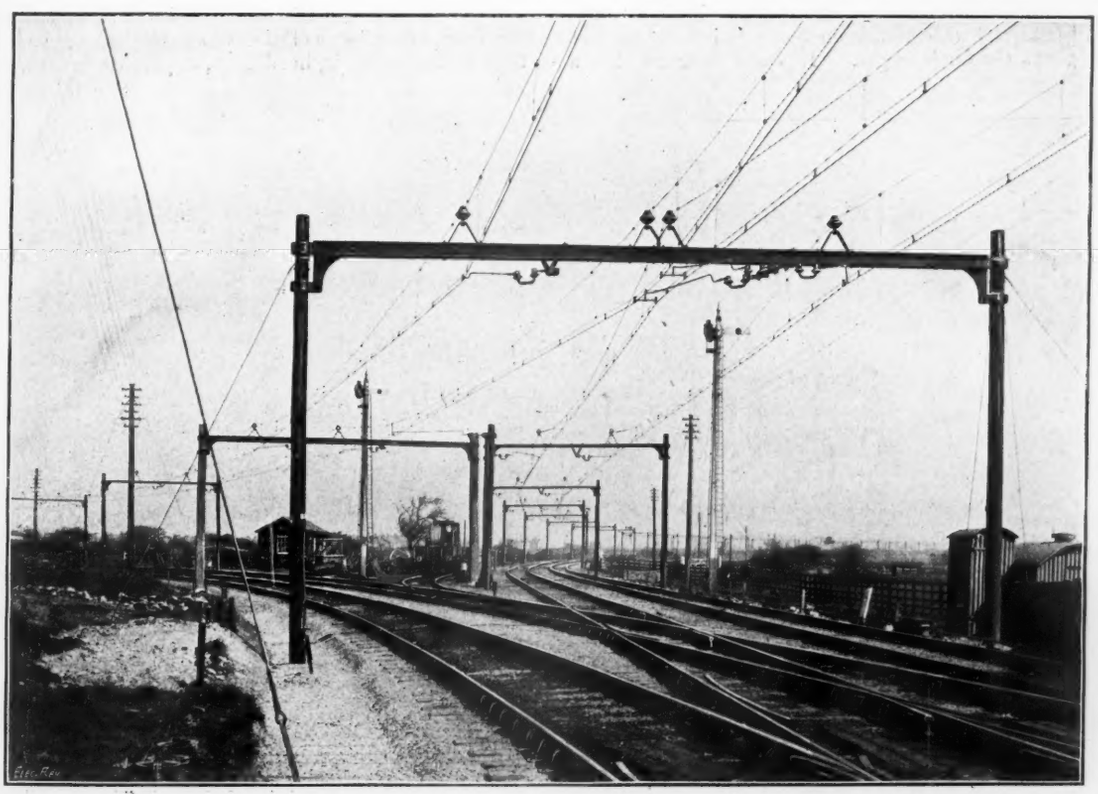


Fig. 2.—Overhead Construction at Torrisholme Junction.

The use of a single bow for travelling in both directions

necessitated the bow being symmetrical about the centre line of the coach ; and it was necessary to take the contact wire well out towards the centre of the arch, placing it low enough for the other side of the bow to clear the structure.

In addition to the bridges, the Lune Viaduct presented a special problem, as it is on a 9-chain curve and terminates at the end of Lancaster Station, which is also on a curve.

The contact wire is of the figure 8 section, 70 sq. mm. section, and is run in lengths of from 800 to 1,000 yd.

One end of each length of the contact wire is fixed through insulators to a terminal gantry, and the other end is attached through suitable pulleys, &c., to a weight equal to about 1,200 lb. The fixed end is always that at which the train enters, and the weighted end that at which the train leaves ; the tendency of the bow is, therefore, always to straighten the contact wire. Experimental trials showed that the total friction of pull-offs, &c., was such as to make it necessary to use a tension of about 1,200 lb. for a 1,000-yard length, and with this tension the strain is fairly uniform throughout the whole length. It was also found that a 4-ft. staggered contact wire, *i.e.*, 2 ft. out of the centre, for a bow which measured from tip to tip 7 ft. 1 in., was too much for practical purposes when running at high speeds. A stagger of 2 ft. is a more practicable figure, though part of the line is actually run with 3 ft. stagger at present.

The height of the contact wire from rail level varies from 18 ft. 3 in. in the open to 13 ft. 3 in. under bridges. It is suspended by short loops about 4 in. long from a steel cable called the auxiliary wire. The loops are fixed to the contact wire, but are movable on the auxiliary wire. The auxiliary wire again is held by the main catenary cables, of which there are two ; the main catenary span being thus broken up into six short spans on the auxiliary.

The two catenary cables are clipped together throughout their length, except for about 3 ft. on either side of the insulator, where they divide to pass through the grooves of a ring, these grooves being on opposite sides of the insulators. The catenary is therefore free to move for this distance, and this equalises the strains in spans due to unequal loading ; at the same time it is secure in the case of the breaking of the wire, as has actually been proved by experience.

Section switches are provided so as to isolate the up and down lines, or to isolate the different branches.

These switches are of the double-break air pattern, and are fixed on the tops of the poles supporting the gantries. Each section switch is, in addition, duplicated, and the connection from one contact wire to the section ahead of it is accomplished by means of a short section of switch wire which requires to be connected to the two contact wires before the line is switched through at this point. This arrangement was adopted in order to get a duplicate break, and, what is more important, a short length of line into

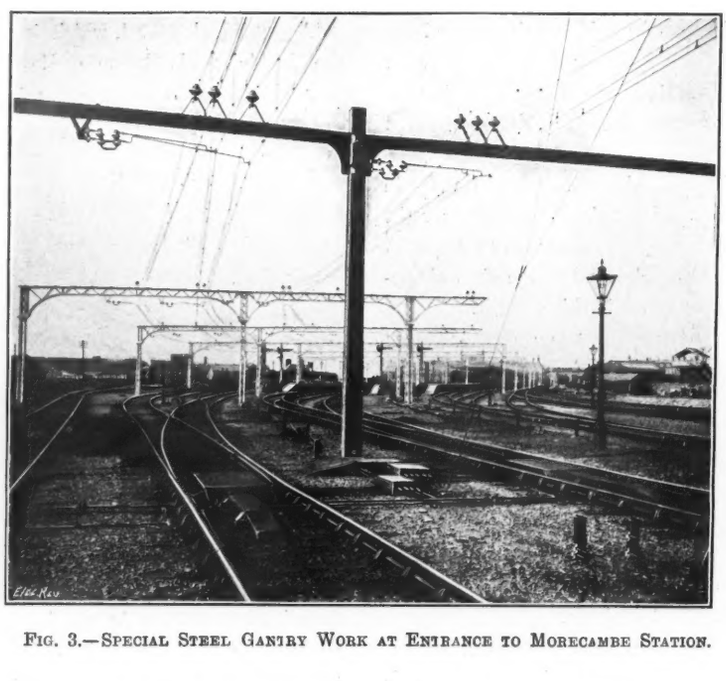


Fig. 3.—Special Steel Gantry Work at Entrance to Morecambe Station.

Fig. 4.—An Under-Bridge near Morecambe.

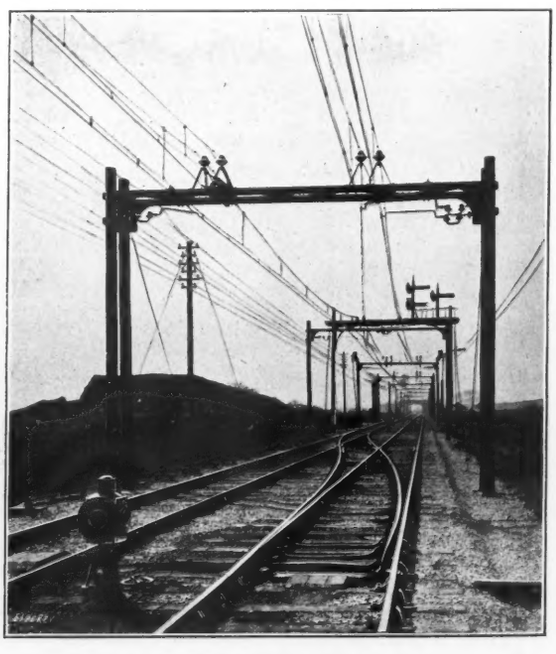


Fig. 5.—Normal Construction between Stations.

which a car can run without bridging by means of its bow two sections which might require to be isolated. The switches are provided with padlocks. A similar type of switch is in use at the various stations to enable the station staff to earth the overhead wiring in case of emergency.

The gantries are connected together by a separate overhead steel cable, which is earthed every half-mile, the same earth plates being used for lightning arresters of the horn type.

This earthed steel cable has been erected in every case between the contact wire and the telegraph wires, which are open on one side of the line, and it is believed that its presence has had a great effect in reducing the electrostatic induction from the contact wire to the telegraph wires.

It was the object of the company to avoid, if possible, cabling their telegraph and telephone wires, and so far the results are favourable to the idea that it will not be necessary to put all such open wires underground when high-pressure traction systems are erected overhead. At the same time it will certainly be necessary to provide some sort of high resistance leak on any wire running parallel to such a system, as in certain circumstances, if the wire became, for instance, thrown out of work by disconnection at the test board, there might be an electrostatic pressure between it and earth with a very high voltage, which would be very inconvenient for maintenance purposes.

The poles are mostly straight creosoted wooden poles, but at Morecambe Station and at one or two other points it has been necessary to erect lattice steel poles and lattice girder gantries, owing to the long spans.

Where wooden poles are used the gantries are made of two angles brought together at the ends, but kept apart for the greater part of their length by distance pieces 1 in. thick, thus enabling the bolts from the insulator saddles

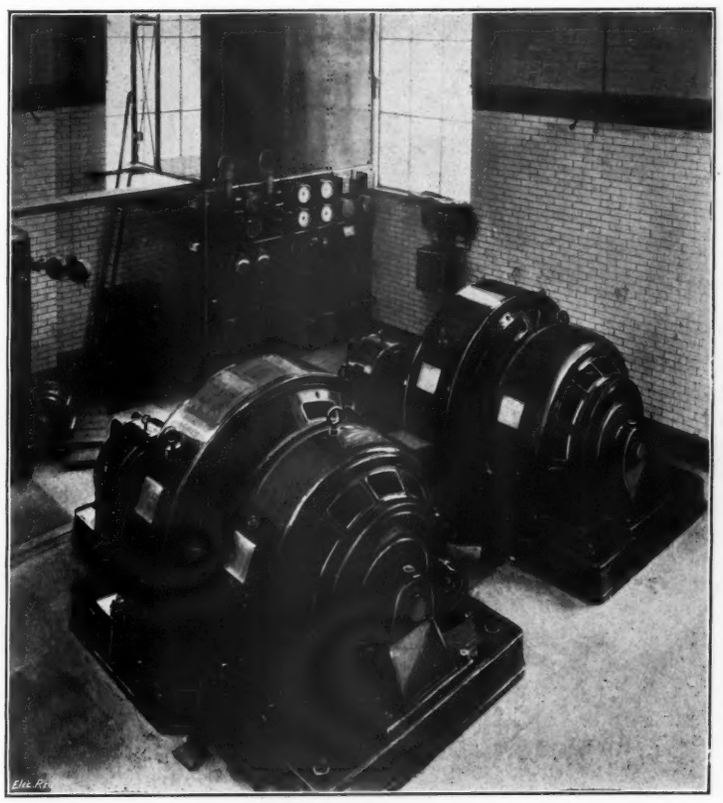


Fig. 6.—Traction Motor-Generators and Switchgear, Heysham Power Station.

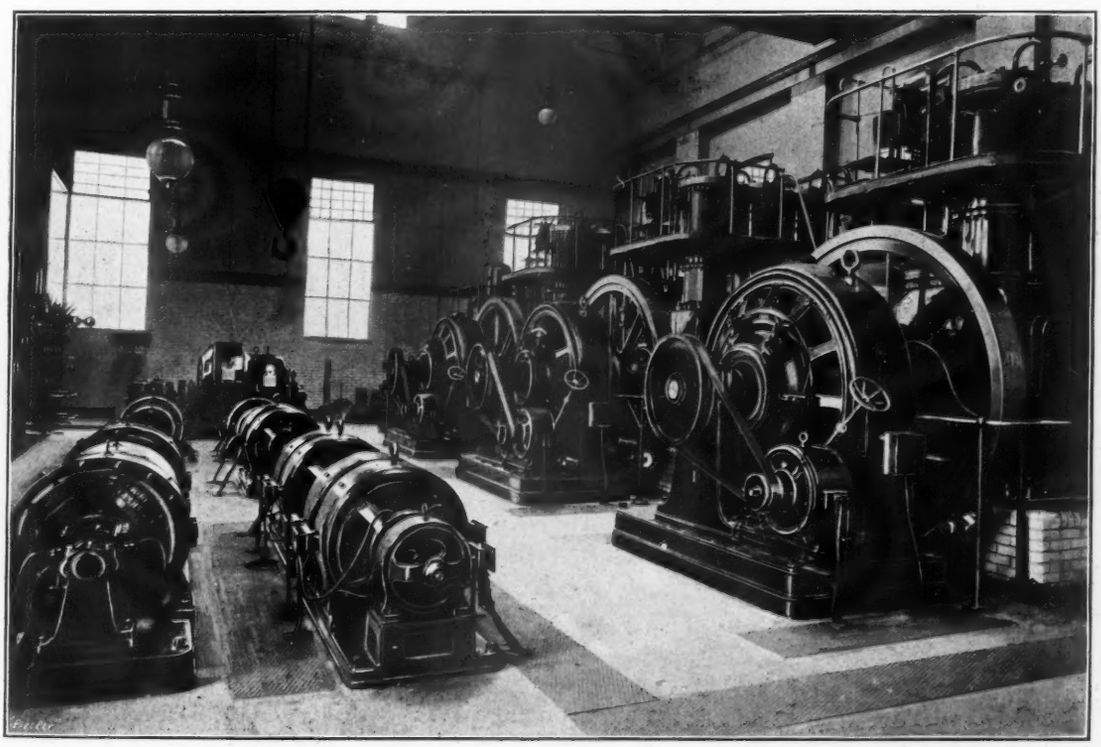


Fig. 7.—General View of the Westinghouse Gas-Electric Generating Plant, Heysham.

to drop into the gap, and so giving a great range of adjustment of the insulator position without any necessity for drilling.

The design of the insulators is shown on page 995. The steel bolts supporting the insulators are encased with ebonite

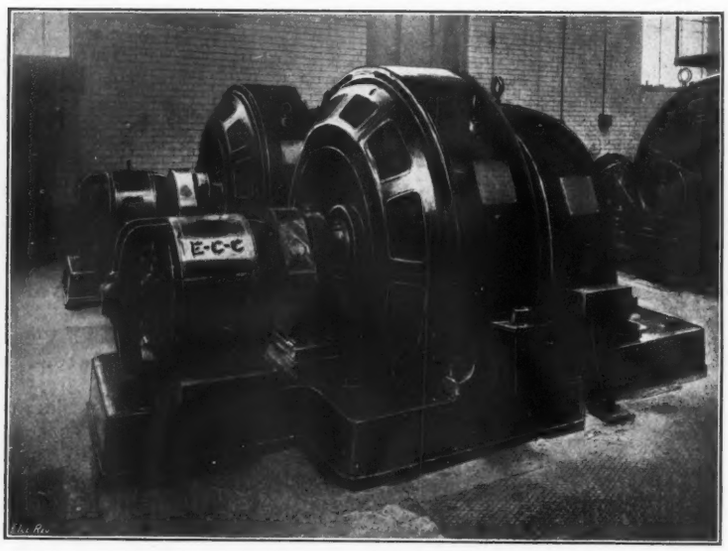


Fig. 8.—Traction Motor-Generators and Exciters.

with a view to getting practically double insulation with one insulator. In addition to this, the insulator itself is in two portions and of massive construction, as a precaution against interference, at the large number of level crossings. It will be seen that the design of the insulator in combination with that of the twin catenary cable brings the side strain of the overhead gear below the level of the inside bolt, and there is no point at which the catenary cable itself is deformed by the pressure of any clamp of any sort, and no point at which the mechanical waves tend to break the wire at a point of reflection.

The outer rail on each line is bonded throughout its length, the bonds being of the Forest City type, in duplicate, and placed under the fish-plates. At all crossings and junctions all the rails are bonded together for greater continuity of contact with the wheels of the coaches; these bonds and those used for cross bonding are ordinary copper cable bonds.

Very great care was exercised in bonding the line to prevent any moisture getting into the drilled holes or on to the bond plugs during the process, but the tests carried out when the whole of the work was finished, showed in an interesting manner that those bonds which were installed in perfectly fine weather were quite distinguishable from those which were fixed in damp or misty weather.

The rails are earthed at Heysham Harbour in the sea by duplicate copper earth plates. At Morecambe they are earthed at the end of the Midland Railway Pier; the plates here also are of copper, dropped into a large cast-iron caisson. At Lancaster the rails are earthed to the cast-iron columns of the bridge in the bed of the river, where water is always flowing.

Recording ammeters were put in circuit with the various earths, with a view of indicating the proportion of current which returns by these routes.

The Heysham Power Station was originally provided for supplying power to the cranes, capstans, lifts, and other machinery, together with the lighting of the harbour at Heysham. The station is gas-driven from two "Mond" producers of about 750 to 1,000 H.P. capacity each, which, with the accessory blowing, steam-producing, cooling, and cleaning apparatus, were supplied by the Power Gas Corporation.

The engine-room originally contained three 250-H.P. three-cylinder Westinghouse engines, driving 150-KW. direct-current generators working at 460 volts. There was also installed a battery having a capacity of 100 KW. for five hours, with the usual corresponding rates for shorter and longer periods. The existing load on the station, consisting chiefly of high-speed, heavy-motored cranes, is very variable, and the battery has been used, in conjunction with a Westinghouse automatic reversible booster, for taking care of the "peak" loads.

In connection with the traction scheme, an additional 350-H.P. 235-KW. Westinghouse engine and generator, also generating direct current at 460 volts, has been added. The

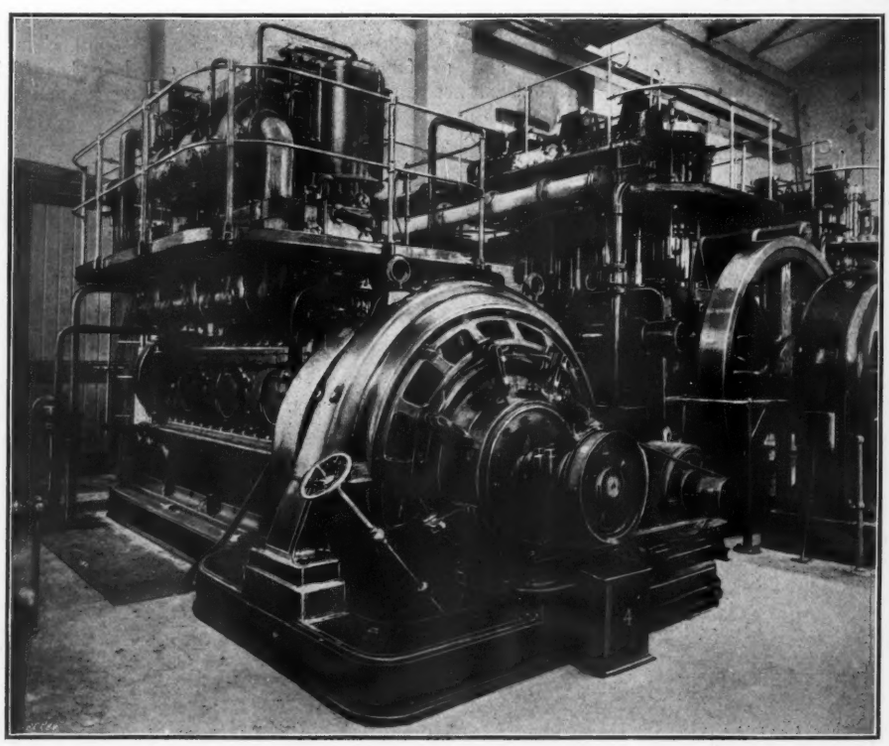


Fig. 9.—Tandem 3-Crank Westinghouse Set Recently Installed in Connection with the Electric Traction Scheme.

single-phase current is obtained through two motor-generators, supplied by the Electric Construction Co.

From the nature of the traffic, the demand on the station will be one with very heavy "peaks." During these "peaks" the whole possible output of the machinery at work

in the station must be utilised, and the intention is for the engines, whatever the actual load they be working on previously to heavy loads coming on, to work up to their full overload capacity, which is about 20-25 per cent. in the case of the old, and 10-15 per cent. in the case of the new sets, before the battery is called upon to discharge heavily. The latter will, however, be called on to work up to its full one-hour rate of 750-1,000 amperes. The old battery booster not being large enough for these discharges, a new one has been installed, built by the Lancashire Dynamo and Motor Co., whose machine is particularly suited for this method of working. A difficulty was, however, met with in that the generators were working on a rapidly falling portion of their characteristics, and their pressure dropped badly as their loads increased.

Compound winding in the usual way would have been an extremely expensive remedy, involving additional coils and trouble in dismantling the machines. A very simple solution was, however, found in fitting 3-KW. exciters, belt-driven from the generator shafts, the compound windings being fitted on these exciters, and varying their voltage, and consequently that on the main generator fields, so that the existing copper on the latter was fully utilised. The

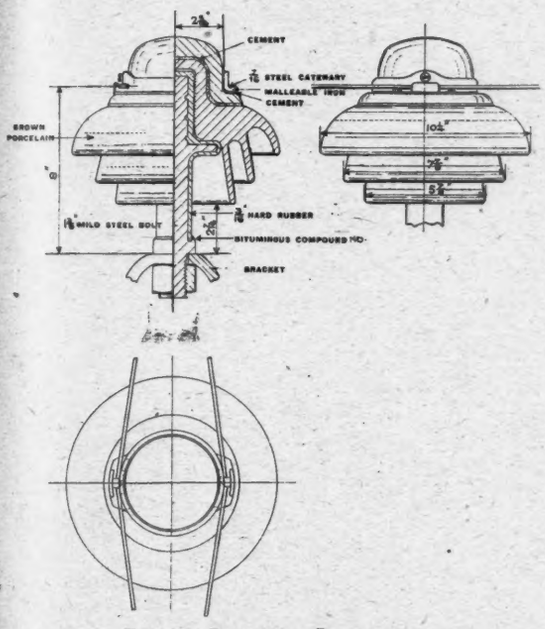


Fig. 10.—Details of Insulator.

whole change was made in the course of a week, obviating any dismantling or any serious stoppage of the generating sets.

As regards the new machines, the Lancashire Dynamo and Motor Co.'s booster is of the firm's standard three-wire type.

The new Westinghouse generating set includes a three-crank gas engine, with tandem cylinders; its performance so far proves it to be an excellent engine, and one as reliable as any steam engine.

The motor-generators deserve special mention; the specification called for the machines to be each capable of a continuous output of 150-200 KW., with a temperature rise of 80° F., but they were also called upon to be capable of safely carrying output overloads of 900 KW. instantaneous, 600 KW. for ½ min., 500 KW. for ¾ min., and 300 KW. for 2½ min, and were required to be also tested under a regular cycle of these overloads, with underloads in between, for 8 hours. On the alternating-current side they were required to regulate within 6 per cent. on throwing off a non-inductive load equal to the full continuous load, and within 20 per cent. on throwing off a similar but inductive load of ·8 power factor; further, they were required, with the assistance of external means if necessary, to restore the pressure to normal within 7 seconds of the coming-on or throwing-off of loads up to 600 KW. at ·8 power factor, or 300 KW. at power factors down to ·3.

The makers' specification was 175 KW. on continuous rating; experimentally each of the sets has several times been subjected to loads up to 900 KW. input without the slightest commutator trouble, and smaller overloads with equally satisfactory results. The alternating-current regulation is also fully up to the specified requirements, and on an average after the switching-on or throwing-off of a heavy load the voltage is restored to its normal of 6,600 volts within three seconds, while the voltage even then only varies about 300 volts each way.

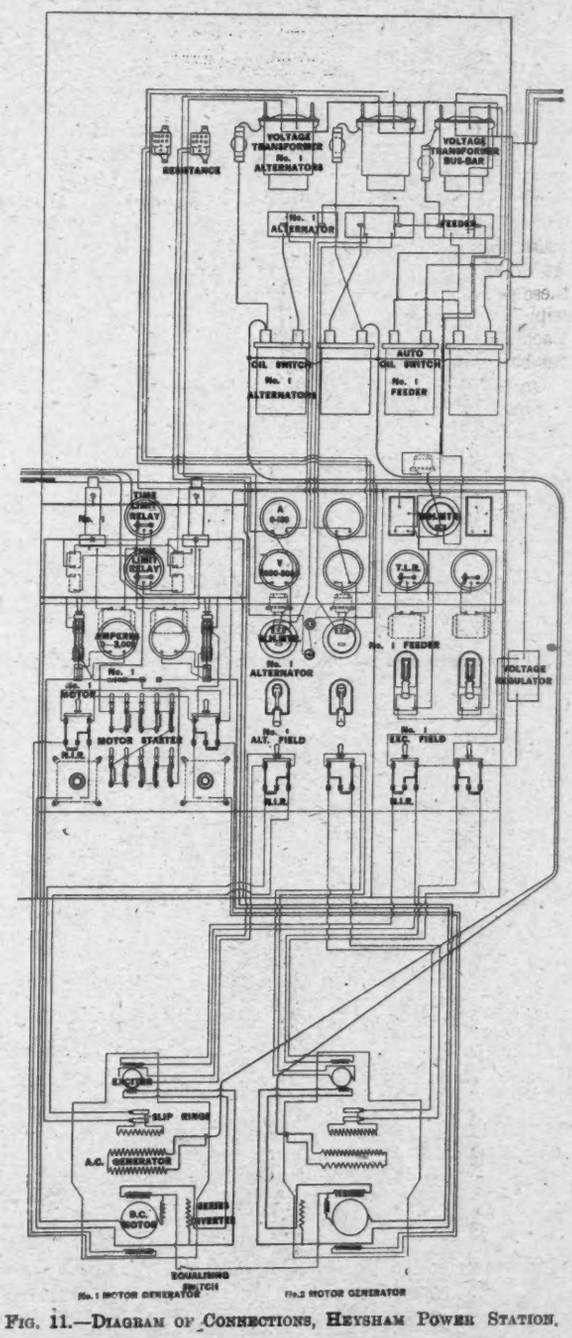


Fig. 11.—Diagram of Connections, Heysham Power Station.

The direct-current motor is compound-wound, with commutating poles, the series winding being principally to assist the two sets to run in parallel; the alternator has a three-phase star winding, so that if one winding breaks down the other two may be used for the single-phase supply, otherwise no use is made of the three-phase connections. The machine is of the standard revolving field type, with an exciter spur-geared to its shaft. This exciter has laminated fields, and is compound-wound, its series-winding carrying a portion of the main motor current, so that (so far at least as varying loads of equal power-factor are concerned) the

tendency of the alternator to drop in volts is thus compensated for.

Compensation for varying power factors is effected by means of a regulator, designed and constructed by the Electric Construction Co., and the first of its kind, which inserts or extracts resistance from the circuit of the shunt field of the exciters by the action of solenoids, which are respectively excited as the voltage exceeds, or is less than, the normal.

There are only two main bearings on the machines, these being ball bearings, which have so far given every satisfaction, and have proved very advantageous in reducing the starting current, which at 460 volts is only about 75 amperes, and the no-load loss, which is about 23 KW. with the exciter and alternator fully excited.

The switchboard has been designed and constructed by the Railway Co., the instruments being of the Westinghouse Co.'s make. Each of the motor-generators is supplied from the L.T. bus-bars through a no-voltage and overload circuit-breaker. The shunt circuit is excited through a separate double-pole knife switch, with kicking contacts and resistances. Starting resistance is cut out by means of a set of knife switches; by means of a throw-over switch, these can be used to start either set of the machines, a heavy triple-bladed knife switch being thrown in finally when the machine is fully started up, connecting it direct to the bus-bars.

On the A.C. side, each alternator is connected up to the bus-bars by a hand-operated oil switch, and the current passes from the bus-bars through duplicate automatic circuit-breakers to duplicate feeders passing out to the overhead lines. All the circuit-breakers, both H. and L.T., have time-limit devices. The exciter shunt fields of the alternators are also connected through double-pole switches, with non-inductive contacts and resistances. The instruments used consist of an ammeter on each of the direct-current motor circuits, and a voltmeter, ammeter and watt-hour meter on each of the alternator circuits, all, as usual, operated through transformers. The incoming wire from the rails is, of course, at "earth" potential. There is also an indicating watt-meter between the bus-bars and the outgoing feeders, and the regulator is connected to the same transformer.

The H.T. apparatus is contained in an expanded-metal chamber placed over the actual switchboard; the door of this chamber is interlocked with the holding-up coil of the motor circuit-breakers, so that unless the door is closed neither motor-generator set can be started, while if it is opened during running, everything stops.

(To be continued.)

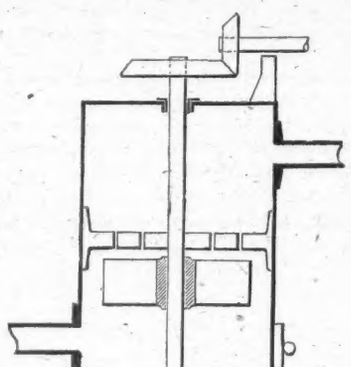
NOTES.

(Continued from page 990.)

Royal Engineers. — LONDON BALLOON COMPANY.—The London Balloon Company of the Royal Engineers has attained the percentage of its establishment requisite for its recognition by the War Office as a formally constituted unit, and application for such recognition has accordingly been made. We are informed that there are still vacancies for drivers and sappers, &c.; the latter should be men with mechanical training or inclination, and, if practicable, with some knowledge or experience of balloon or man-lifting kite work. The Company is now on an active footing, and in order to gain the most advantage from the training the establishment should be fully made up without delay. The Company will proceed to Aldershot this summer for training with the Army Ballooning School. Full particulars of the conditions of service—which are very similar to those of the late Volunteer Force—can be obtained at the Headquarters of the Company, Regency Street, Westminster, S.W.

BIRMINGHAM TELEGRAPH ENGINEERS.—The Southern Wireless, Cable, and Air Line Companies of the Royal Engineers (Birmingham) having attested the 30 per cent. of their authorised establishment, have now received the recognition of the Army Council. As an actual fact, says the *Birmingham Daily Mail*, the Wireless and Cable Companies have enlisted each 50 per cent., and the Air Line Company 35 per cent. of the required number. These figures are highly creditable, and Lieutenant J. F. Lister and all who have worked with him to achieve so excellent a result in so short a time are deserving of every commendation.

Condenser Cooling-Water Suction. — Trouble has frequently occurred in power stations having condenser arrangements, due to the fact that the grating of the suction piping leading to the condenser cooling-water pumps has become choked by means of refuse drawn from the river or pond containing the cooling water, and when it is considered that the whole safety of the station supply may depend upon the proper obtaining of water through a grating measuring, let us say, 6 ft. square, the seriousness of the problem can be realised. Engineers in practical charge of power house plant will be aware of the frantic measures sometimes adopted to clear the strainers of suction water inlets. Men have been sent with long poles to probe around the strainers in order to clear the refuse, and have frequently succeeded only in jamming it further into the gratings. Where it has been possible to remove



SUCTION CHAMBER.

the gratings, either by ordinary or extraordinary means, the engineer-in-charge of the plant has even given instructions for the gratings to be knocked away in order to allow water, refuse and everything else to pass through to the pumps, in order to maintain the supply. This means grave risk of breaking up the plant and a certain overhauling of the valves at no distant date.

For the purpose of getting over this difficulty to a certain extent, the accompanying sketch suggests an arrangement which might well be adopted. A circular rotating device, practically consisting of a small turbine, is placed between the suction from the river or pond and the perforated grating which forms the strainer. This turbine is driven by means of the engine itself or a small motor. In the chamber below the turbine is placed a door which can be opened to clear out the refuse which accumulates, and the water can be by-passed during cleaning operations. The effect of swirling the water in this way just in front of the strainer would be to keep the perforated grating clear of refuse which might happen to come through, and there would also be the effect of assisting the pump to gain its water during times of trouble due to low water in the river.

American Co-operation.—An announcement has just reached us of the award of some very substantial prizes given by the American Co-operative Electrical Development Association for a canvassers' handbook. The premier prize of 200 guineas is taken by an English consulting engineer, Mr. R. Borlase Matthews, who is well known to our readers as a contributor to our columns and as an expert in the organisation and operation of publicity departments for electricity supply undertakings. Those who have had to deal with canvassers in connection with electric light undertakings must have felt the need of data, suitably arranged, to put into the hands of men employed in seeking for new business, and it was with this need in view that the American Association decided to offer substantial prizes amounting to a total of £540 for a handbook containing information which would not only be useful to canvassers, but also to central-station managers and their staffs. Some 54 contributions were received, representing a collection of very valuable data, which is to be published and distributed among the 5,000 central-station managers in the United States, and the effect of such dissemination must be of considerable value to the electrical industry as a whole.

Electrical Engineer's Death.—Mr. Thomas Martin, thirty-one years of age, of Wigan, employed by the Corlett Electrical Engineering Co., died last week under tragic circumstances in the Wigan Infirmary. He had gone into that institution to undergo an operation, when he suddenly expired. Medical evidence showed that death was due to shock—to severe fright—and a verdict in accordance therewith was returned.

Fatalities.—Whilst engaged at Messrs. Dewhurst's Cuerden mill, Bamber Bridge, on June 4th, an electrical wireman named Richard Slater, 29, met a shocking death. He, along with a man named Edwards, was working on a scaffold 6 ft. from the floor, fitting wires for electric lighting. Edwards was cutting some iron piping, when he heard deceased shout "Oh!" and discovered that Slater was trying to release his jacket, which was fast to a shaft used for driving looms. Edwards tried to release him, and he shouted for help, but his efforts were powerless, and he was himself knocked off the scaffold. His companion's body was whirled

round the shafting and was thrown, almost stripped and terribly mutilated, to the floor.

A woman met her death on the N.E. Railway, near Backworth, on Wednesday last week, through coming into contact with the live rail.

At the inquest on Edward King, the battery man, who, as already reported, met his death from electric shock at the works of Messrs. Siemens Bros., at Woolwich, the jury returned a verdict of "Accidental Death," and recommended that the firm should raise the switchbox and the connecting wire higher than a man's head.

Institution and Lecture Notes. — INSTITUTION OF ELECTRICAL ENGINEERS (LEEDS LOCAL SECTION).—An excursion has been arranged for Saturday, June 20th, to Nidderdale, the route passing through charming scenery to Lofthouse, Middlesmoor and Angram; at the last-named place the Bradford Waterworks will be visited, there being a three-phase plant driven by water-power, an aerial ropeway, and other interesting features. Those who wish to join the party should reply as soon as possible, not later than June 15th, to Mr. H. Dickinson, hon. sec., Leeds Corporation electricity works.

FARADAY HOUSE OLD STUDENTS' ASSOCIATION. — The fourth annual dinner of this Association will be held at the Queen's Hotel, Leicester Square, W., on Thursday, June 18th, at 7 for 7.30 p.m., Mr. Gerald W. Partridge, M.I.E.E., M.I.C.E., President, in the chair.

EAST LONDON COLLEGE.—On Mondays, June 15th, 22nd and 29th, at 8 p.m., Prof. J. T. Morris will lecture on "Recent Developments in Electric Lighting." Some particulars are given in an advertisement. A great deal of experimental work has been done at the College in the photometric examination of various lamps, and tests have been made of incandescent mantles with high-pressure gas and with the most recent types of flame arc and glow lamps. Permission to attend these lectures can be obtained, free of charge, on application to the Registrar of the College.

Franco-British Exhibition.—On Wednesday last there was a special demonstration of the exhibits in the Science Court, at which members of the Science Committee were present. The collection is of exceptional interest, covering an extremely wide range of modern scientific progress.

Explanation.—The secretary of the Hart Accumulator Co., Ltd., of Stratford, E., writes as follows:—"Some misunderstanding having arisen through the notice published in your current issue relative to the winding-up of the Hart Secondary Battery Syndicate, Ltd., I should like to state that this liquidation in no way affects the Hart Accumulator Co., Ltd., beyond the fact that the Hart Accumulator Co., Ltd., have purchased the foreign patents of the Syndicate, with the intention of further developing their foreign and colonial trade in accumulators. The similarity of name has evidently caused some confusion, and I should be very glad if you will give me the opportunity of making this explanation."

Siemens & Halske.—The Berlin correspondent of the *Financial News* wiring on June 9th, says:—"The electrical concern of Siemens & Halske has decided to increase its capital by 8,500,000 marks, to 63,000,000 marks, in order to take up the shares of subsidiary concerns at Vienna, St. Petersburg and London."

Appointment Vacant. — Visiting teacher of electric wiring for the L.C.C. School of Engineering and Navigation at Poplar. See "Official Notices" to-day.

Supervision of Electrical Stations in Germany.—The widespread opposition to the Prussian Government Bill respecting the supervision of electrical works and installations, to which reference was made in our issue of March 13th, has now reached a further stage by the holding of a conference in Berlin, under the auspices of the Union of Electrical Engineers, on May 23rd. The conference was attended both by engineers and by representatives of the manufacturing industries throughout Prussia, and a resolution was adopted for presentation to the Minister for Home Affairs, drawing attention to the serious objections raised against the Bill, and asking for amendments. At the express wish of interested industrial circles, the text of the Bill proposing police regulations in respect of the supervision of electrical installations was published recently in the official communications of the Ministry for Trade, in order that an opportunity might be given to interested parties at the last moment to express their views in respect of the regulations. It appears that the Government department has declined to discuss the main question as to whether any supervision is requisite, on the ground that the scheme represents a demand which has repeatedly been made in the Prussian Diet. The large electricity companies have several times been requested to form associations for the supervision of installations by experts, but they have not complied with the suggestion. Now, however, they have expressed the desire to have their electricity works and all the connections made by them supervised by their own officials, but the Government will not agree to this proposal. It is rather considered, in Government circles, that supervision by expert officials of the steam boiler supervision associations, which is also of a private character, would be more practicable for reasons of impartiality. As to the scheme itself, an expert among the opponents states that their apprehensions, in the first place, are not so much directed against what is embodied in the project as against a point which is not contained in it. The scope of activity of the "official experts," he explains, is not restricted to the testing of electrical installations in order to see that they comply with the regulations in respect of safety from accident or fire, but they are given a free hand in every direction. It is, therefore, feared that these gentlemen will regard themselves as experts in all possible electrical questions, and cause themselves to be consulted, and in a certain measure act as the highest court, similarly to the consulting engineers in England. The experience of any individual engineer is, however, such, it is contended, that the exercise of the influence of official experts could not in many cases be of advantage in all kinds of questions relating to projects and constructional works. In these circumstances, it is held to be desirable that the privileges of the official inspectors should be limited to the purpose of supervision from the standpoints of fire and accident dangers. This wish is all the more justified from the fact that the supervision is to be entrusted to the existing steam-boiler supervision associations with the addition of some young electrical engineers. The head of the electrical engineers would consequently be a practical man in boiler and engine technology, and he would soon interfere with the complicated questions in connection with the control of electrical installations. It would, however, be impossible for him to gain an immediate knowledge of the problems; and the electrical engineers would have to be men of the first rank in order to be able to draw up technical reports, but such men are not obtainable. In the first place, the salaries of from £150 to £200 per annum that are offered would not attract the right men; and, secondly, leading men would not permanently devote themselves to the monotonous work of inspecting electrical installations. In conclusion, it is submitted that the projected regulations are of too elastic a character, and that, as they leave the final decision in the hands of the official experts, the latter, in order to be on the right side, would be rather too strict than too easy. The bringing of the regulations into force, it is apprehended, would be followed by the demand for the introduction of all kinds of modern equipment in thousands of existing installations; and it is urged that in cases of dispute a higher authority should be appointed to report, preferably composed of members selected from the Safety Committee of the Union of Electrical Engineers.

Our Annual Tables.—Corrections for the Electricity Supply Works Table can be received up to Friday next at latest.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the ELECTRICAL REVIEW *posted as to their movements.*

Central Station Officials.—On resigning the position of general manager and engineer to the Sheerness Electric Power and Traction Co., to take up a position at Musselburgh, MR. A. A. WATKINS has been presented by the staff with a barometer, and MRS. Watkins with a pair of silver glove stretchers. Mr. Watkins is succeeded at Sheerness by MR. G. L. KIRK.

The Grimsby T.C. has increased the salary of the electrical engineer (MR. VIGNOLES) from £400 to £500 per annum, by three yearly increments of £50, £25 and £25 respectively.

The Partick T.C. has increased the salary of the burgh electrical engineer (MR. W. SILLERY) by £100, that of the chief clerk (MR. A. E. THOMAS) by £14, and that of the station superintendent (MR. S. LITTLEHAILES) by £10 per annum.

MR. R. H. FENWICK, charge engineer of the lighting and tramways power station at Beckenham, has been selected for a similar position in the Dewsbury Corporation electricity works.

Tramway Officials.—The Liverpool City Council, at the monthly meeting on June 4th, confirmed the appointment of MR. C. W. MALLINS as general manager of the Liverpool Corporation Tramways. Mr. Mallins has been connected with the Liverpool tramways for many years, and has acted in the capacity of traffic manager for the past 10 years.

The South Shields T.C. has appointed MR. L. E. HARVEY, assistant tramway manager at Sunderland, as manager of the tramways.

The members of Halifax T.C. have presented an oak roll-top desk to MR. FREDK. SPENCER, late tramways manager, as a token of esteem.

At Hamilton last week Inspector JOHN WILLIAMSON, of the Lanarkshire Tramway Co., was presented with a number of gifts by his fellow employés on the occasion of his marriage. Mr. Downes, traffic manager of the company, made the presentation.

MR. J. B. HAMILTON, Corporation tramways manager at Leeds, recently celebrated his silver wedding. On 3rd inst., in commemoration of the event, he was presented by practically the whole of the tramway staff and employés (some 1,500) with a silver rose-bowl, a pair of silver candlesticks, and a meerschaum pipe. The presentation was made by Mr. R. A. Smithson, deputy chairman of the Tramways Committee.

General.—The Council and Senate of the Liverpool University have decided to confer the honorary degree of Doctor of Engineering upon the HON. CHAS. A. PARSONS, M.A.

MESSRS. KENNEDY & JENKIN announce that they have taken into partnership Mr. John Macfarlane Kennedy and Mr. Sydney Bryan Donkin. The name of the firm remains unaltered.

At All Hallows Church, Bruce Grove, N., on June 4th, the marriage took place of MR. W. K. PARTINGTON, the principal

of the firm W. K. Partington & Co., electrical and mechanical engineers, and Miss Esther Smith.

Mr. W. G. Scott, who has been for the past 4½ years with the Brush Electrical Engineering Co., Ltd., as resident engineer on many of their tramway and transmission line constructions, has resigned that office in order to accept a position with the Bombay Electric Supply and Tramway Co., Ltd., and sails for Bombay on Thursday, June 11th, 1908.

NEW COMPANIES REGISTERED.

Premier Electric Heaters, Ltd. (98,245).—This company was registered on June 4th, with a capital of £2 000 in £1 shares, to adopt an agreement with G. H. Collins and H. F. Collins for the acquisition of the business carried on as the "Premier Electric Heating Co." and to carry on the business of manufacturers and sellers of electrically heated appliances of all kinds, resistances for heaters, controllers and regulators, &c. The subscribers (with one share each) are:—A. Barter, 61, Pershore Road, Birmingham, electrician; Mrs. E. Collins, 85, St. Luke's Road, Birmingham; A. J. Collins, 124, Herbert Road, Plumstead, electrician; W. T. Tonkin, 51, Gains Road, Southsea, Hants., first-class officer, Inland Revenue Department; G. H. Collins, 85, St. Luke's Road, Birmingham, engineer; F. Mackenzie, 170, Pitsford Street, Hockley, Birmingham, electro-plate worker; H. F. Collins, 85, St. Luke's Road, Birmingham, engineer. No initial public issue. The number of directors is not to be less than two or more than seven; the first are G. H. Collins, H. F. Collins and A. J. Collins; qualification, £100. Registered office, Ashley Street, Birmingham.

Magneta Time Co., Ltd. (98,242).—This company was registered on June 4th, with a capital of £30,000 in £1 shares, to take over the business and assets of manufacturers and installers of, and dealers in, synchronised time systems carried on by the Magneta Fabrick Electrische Uhren Actien Gesellschaft, of Zurich, at Millbank, London, and elsewhere (but only in the United Kingdom) as the "Magneta Co.," also to acquire for a certain period, the services of A. R. Upward. The subscribers (with one share each) are:—A. R. Upward, Millbank House, S.W., consulting engineer; F. Coveli, 4, Arundel Street, Strand, W.C., solicitor; W. L. M. Benson, 4, Arundel Street, Strand, W.C., solicitor; K. H. Young, Balgowan, Dorking, law student; W. H. Glendining, 4, Arundel Street, Strand, W.C., clerk; E. S. Saxon, 4, Arundel Street, Strand, W.C., clerk; L. P. Turner, 4, Arundel Street, Strand, W.C., clerk. No initial public issue. The number of directors is not to be more than three; the first are A. R. Upward, and one or two others to be nominated by the subscribers. Registered office, Millbank House, Millbank, London.

Orling's Telegraph Instruments Syndicate, Ltd. (98,244).—This company was registered on June 4th, with a capital of £1,500 in £1 shares, to acquire the benefit of certain provisional protections in respect of improvements in electro-capillary apparatus for the transmission of a series of electric impulses along landlines or cables, and for improvements in cable telegraphy, to adopt an agreement with A. Orling, and to carry on the business of electrical and mechanical engineers, manufacturers of electrical and other apparatus, appliances, and machinery, &c. The subscribers (with one share each) are:—J. M. Horner, 51, Moorgate Street, E.C., engineer; F. W. Burger, 23, Coleman Street, E.C., merchant; T. Inkersole, 17, Coverdale Road, W., secretary; A. Orling, 15, Victoria House, South Lambeth Road, S.W., electrical engineer; W. T. Moore, 24, Budge Row, E.C., solicitor; V. A. Wood, 154, Underhill Road, E.C., clerk; E. Oldenburg, 11, Victoria House, South Lambeth Road, S.W., merchant. No initial public issue. Registered without articles of association by W. T. Moore, 24, Budge Row, E.C.

C. Larkins & Co., Ltd. (98,238).—This company was registered on June 4th, with a capital of £1,500 in £1 shares (1,400 preference), to adopt an agreement with S. O. Hoad and F. P. Spicer for the acquisition of the business carried on by them at Bush Lane House, E.C., as "C. Larkins & Co.," and to carry on the business of electrical and general engineers and contractors, builders, decorators, bank, office and shop fitters, &c. The subscribers (with one share each) are:—F. L. Spicer, 6, Clifton Road, Rugby, engineer; R. T. Dalton, 57, Clarence Road, Wood Green, builder; E. Adams, 69, St. James Road, Croydon, Civil servant; A. L. G. Distin, 11, Melrose Terrace, Shepherd's Bush Road, W., gentleman; F. P. Spicer, Ashwood, Lower Addiscombe Road, Croydon, electrical engineer; S. O. Hoad, 80, Acre Lane, Brixton, electrical engineer; P. W. Ladcoat, 50, Highbury Grove, N., secretary. No initial public issue. The number of directors is not to be less than two or more than ten: the first are S. O. Hoad and F. P. Spicer (both permanent; special qualification 25 ordinary shares). Qualification of ordinary directors, one ordinary share; remuneration (except managing director) £1 per annum, divisible. Registered office, Bush Lane House, Bush Lane, Cannon Street, E.C.

Electro-Hydro," Ltd. (98,155).—This company was registered on May 29th, with a capital of £1,000 in 900 10 per cent., participating preference shares of £1 each, and 2,000 ordinary shares of 1s. each, to carry on in Manchester and elsewhere the business of an electro-medical and electro-hydropathic establishment, to acquire the electrical apparatus, appliances and utensils, &c., installed at 344, Bury New Road, Manchester, and to adopt an agreement with J. Brown. The subscribers (with one preference share each) are:—Margarita de Abaitua, 344, Bury New Road, Manchester, trained nurse; D. H. Bailey, 2a, Portland Crescent, Leeds, physician; J. Brown, 344, Bury New Road, Manchester, electro-hydropathist; S. Beet, 63, Hill Street, Toxteth Park, Liverpool; T. Cotton, 27, Brazennose Street, Manchester, estate agent; W. B. Brown, 27, Brazennose Street, Manchester, manager; Maude Cotton, 110, Rochdale Road, Manchester, confectioner. No initial public issue. The number of directors is not to be less than two or more than seven; the first are T. Cotton, and J. Brown; qualification, 50 shares; remuneration, one guinea each per meeting attended. Registered office, 344, Bury New Road, Manchester.

Bankfoot Power Co., Ltd. (98,134).—This company was registered on May 28th, with a capital of £40,000 in £1 shares, to erect a generating station at Bankfoot, near Crook, Durham, for utilising the gases and waste heat produced by coke ovens to be erected by Pease & Partners, Ltd., and for generating electrical energy for distribution and sale, to adopt agreements with Pease & Partners, Ltd., and the Newcastle-upon-Tyne Electric Supply Co., Ltd., and to carry on the business of suppliers of electrical energy in all its branches. The subscribers (with one share each) are:—A. Pease, Hummersknott, Darlington, coal-owner; F. Stobart, Biddick Hall, Fence Houses, coal-owner; T. Y. Greener, West Lodge, Crook S.O., Co. Durham, mining engineer; J. A. Parker, 92, Northgate, Darlington, secretary; F. S. Newall, Castle Hill, Wylam-on-Tyne, gentleman; J. T. Merz, The Quarries, Newcastle-on-Tyne, gentleman; R. P. Sloan, Craiglea, Graham Park Road, Gosforth, engineer; M. Short, Royal Exchange Buildings, Newcastle-on-Tyne, secretary. No initial public issue. The number of directors is not to be less than three or more than six; the first are J. T. Merz, F. S. Newall, and R. P. Sloan (nominated by the subscribers for the "Newcastle" shares, and A. F. Pease, F. Stobart and T. Y. Greener (nominated by the subscribers for the "Pease" shares); remuneration as fixed by the company. 20,000 shares are issued to the Newcastle-upon-Tyne Electric Supply Co., Ltd., and 20,000 to Pease & Partners, Ltd. Registered office, Collingwood Buildings, Collingwood Street, Newcastle-on-Tyne.

Sun Power Co. (Eastern Hemisphere), Ltd. (98,130).—This company was registered on May 27th, with a capital of £300,000 in 1,500 founders' shares of 1s. each, and 299,925 ordinary shares of £1 each, to acquire any inventions relating to the utilisation of solar heat, and apparatus used in connection therewith, in particular to acquire the rights for the Eastern Hemisphere relating to certain inventions of F. Shuman, of Philadelphia, U.S.A., to adopt an agreement with the said vendor, as President and on behalf of the Sun Power Co., of Tacony, Philadelphia, to manufacture and deal in sun or solar engines, and plant, works, apparatus and machinery of all kinds, including machinery and apparatus for refrigerating and ice-making, and for the production or supply of liquid air, electricity, light, heat and power, to manufacture, create, generate, produce and deal in and with ice, liquid air, electricity, light, heat and power of any kind, &c. The subscribers are:—F. Shuman, 3,400, Disston Street, Tacony, Philadelphia, Pa., engineer, 1,500 founders' shares; F. Goswin, Hayes, Middlesex, merchant, 1 ordinary share; G. Despret, Jeumont (Nord, France), engineer, 1 ordinary share; W. Seyrig, 8, Rue Rembrandt, Paris, civil engineer, 1 ordinary share; E. N. Shackle, Botwell House, Hayes, Middlesex, land agent, 1 ordinary share; V. Wilson, 5, Grosvenor Crescent, London, barrister, 1 ordinary share; A. S. Pleus, 2, Basinghall Avenue, E.C., merchant, 2 ordinary shares. No initial public issue. The number of directors is not to be less than three or more than 11; the first are F. Shuman, G. Despret, F. Goswin, W. Seyrig, and E. N. Shackle; qualification, one founders' or £100 ordinary shares or stock; remuneration (except managing director), £300 per annum, divisible. Each founders' share confers the right to participate in the profits of the company, to the same extent as 100 fully-paid ordinary shares.

Railway Audible Signal Co., Ltd. (98,174)—This company was registered on May 30th, with a capital of £50,000 in £1 shares, to acquire any patents, inventions, licences, concessions and the like relating to the production, treatment, storage, application, distribution and use of electricity, in particular to certain existing inventions relating to signalling on railways, to adopt an agreement with the said syndicate, and to carry on the business of manufacturers of and dealers in signalling apparatus, railway rolling stock, &c. The subscribers (with one share each) are:—S. T. Hargreaves, 52, Coleman Street, E.C., solicitor; T. W. Hargreaves, 52, Coleman Street, E.C., solicitor; R. Harradine, 52, Coleman Street, E.C., solicitor; G. R. Campbell, 52, Coleman Street, E.C., solicitor; W. C. Crofts, Cotswold, Crescent Road, South Norwood Park, S.E., gentleman; Florence Ridge, 147, Brighton Road, Croydon, shorthand writer; T. H. Archer, 52, Coleman Street, E.C., housekeeper. Minimum cash subscription 5 per cent. of the shares offered to the public; the number of directors is not to be less than three or more than seven; the first are W. Dawson, Cote, Audley Road, Hendon; H. G. Drury, St. Oswalds, Downes Road, Clapton, N.E.; A. Haes, 17, Bishopsgate Street, E.C.; W. A. Hart, 23, Westbourne Villas, W.; and T. Eaton, 21, Corfton Road, Ealing, W.; qualification, 100 shares; remuneration, £600 per annum, and such further sums, not exceeding £400 in any year, as the company shall determine.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

British Power Co., Ltd. (64,780).—This company's annual return, made up to December 31st, 1907, was filed on May 14th. 6,965 shares have been taken up out of a nominal capital of £250,000 in £10 shares. £62,650 has been received. Mortgages and charges: £35,900.

British Prometheus Co., Ltd. (Kingston) (74,889).—Issue on May 8th of a £50 5 per cent. debenture, part of series created October 30th, 1907, to secure £3,500, charged on the company's undertaking and property, present and future, including uncalled capital. No trustees. Previously issued of same series: £2,700.

Electric and Ordnance Accessories Co., Ltd. (71,240).—This company's annual return was filed on May 30th, when the entire capital of £150.000 in £1 shares had been taken up £1 per share has been called up on 110,000 and 5s. per share on 40,000, and £120,000 has been received. £30,000 (15s. per share) is considered as paid on 40,000 shares. Mortgages and charges: £180,000.

Wycombe (Borough) Electric Light and Power Co., Ltd. (53,183).—This company's annual return was filed on April 16th, when 8,000 shares had been taken up out of a nominal capital of £50,000 in £5 shares; £40,000 has been received. Mortgages and charges: £40,000.

Hove Electric Lighting Co., Ltd. (36,942).—This company's annual return was filed on March 27th, when 15,000 ordinary and 2,722 preference had been taken up out of a nominal capital of £100,000 in 15,000 ordinary and 5,000 preference shares of £5 each; £5 per share has been called up on 15,000 and £4 per share on 2,722 shares, and £85,888 has been received, in addition to £1.456 paid in advance on preference shares. Mortgages and charges: £44,600.

Newcastle-upon-Tyne Electric Supply Co., Ltd. (27,997).—This company's annual return was filed on March 31st, when 87,500 preference and 87,500 ordinary shares had been taken up out of a nominal capital of £1,500,000 in 150,000 preference and 150,000 ordinary shares of £5 each; £5 per share has been called up on 76,741 preference and 79,529 ordinary, and £781,350 has been received; £93,550 is considered as paid on 10,759 preference and 7,971 ordinary. Mortgages and charges: £787,500. (The nominal capital was increased from £1,000,000 to the present amount on March 10th.)

County of Durham Electrical Power Distribution Co., Ltd. (61,591).—This company's annual return was filed on March 28th, when the entire capital of £500,000 in 50,000 preference and 50,000 ordinary shares of £5 each had been taken up and paid for in full. Mortgages and charges: £219,643.

Witney Electric Supply Co., Ltd. (62,336).—This company's annual return was filed on May 13th, when 2,849 preference and 2,802 ordinary shares had been taken up out of a nominal capital of £10,000 in 5,000 preference and 5,000 ordinary shares of £1 each; £4,629 2s. 6d. has been received, including £3 2s. 6d. paid on 25 forfeited shares, and leaving £21 17s. 6d. in arrears. Mortgages and charges: £3,500.

Gould Storage Battery Co., Ltd. (London) (90,877).—Issue on May 22nd of £450 6 per cent. debentures, part of series created May 21st, 1908, to secure £5,000 charged on the company's property, present and future, including uncalled capital. No trustees. Previously issued of same series: £50.

Korting Bros., Ltd. (78,308).—This company's annual return was filed on May 11th, when the entire capital of £50,000 in £5 shares had been taken up. £1 10s. per share has been called up, resulting in the receipt of £15,000. Mortgages and charges: Nil.

Alderley and Wilmslow Electric Supply, Ltd. (47,633).—This company's annual return was filed on May 16th, when 5,009 shares had been taken up out of a nominal capital of £30,000 in 20,000 ordinary and 10,000 preference shares of £1 each. £5,009 has been received. Mortgages and charges: £5,000.

W. T. Glover & Co., Ltd. (56,124).—This company's annual return was filed on April 3rd, when the entire capital of £214,850 in 100,000 preference and 114,850 ordinary shares of £1 each had been taken up. £1 per share has been called up on 67,000 preference and 50,000 ordinary shares, and £117,000 has been received; £97,850 is considered as paid on 50,000 preference and 47,850 ordinary shares. Mortgages and charges: £180,000.

Stothert & Pitt, Ltd. (engineers, makers of electric cranes, &c., Bath & London), (74,218).—Issue on April 27th of £1,100 4 per cent. debentures, part of series created September 30th, 1902, to secure £25,000, charged on the company's undertaking and property, present and future, including uncalled capital. No trustees. Previously issued of same series: £22,900.

Delhi Electric Tramways and Lighting Co., Ltd. (88,758).—Issue on April 29th of £3,100 debentures, part of series created January 3rd, 1908, to secure £50,000, charged on the benefit of the Delhi Municipality Electric Licence of 1905, and the Delhi (Municipality) Electric Tramway Order, 1906, certain land in Circular Road, Delhi, between Lahore and Cabool Gates, containing 6,234 sq. yds., together with the buildings and erections thereon, tramway line, generating station and plant, and the company's undertaking and other assets, present and future, except uncalled capital. Trustees: R. C. Pearman, 21, Old Buildings, Lincoln's Inn, W.C.; and J. Greig, 18, Belsize Park Gardens, N.W. Previously issued of same series: £26,900.

Nairobi Electric Power and Lighting Co., Ltd. (London), (87,728).—A mortgage or charge contained in a scrip certificate dated April 23rd, 1908, to secure £250, has been registered. Property charged: The company's undertaking and property, present and future, including uncalled capital, but excluding £1,500 deposited in the joint names of the Crown Agents for the Colonies and the National Bank of India, Ltd.; uncalled capital on 16,000 shares to be hereafter numbered; and the contract dated July 26th, 1906, between the Crown Agents and C. Hertzel, save as the company shall hereafter with the previous consent of H.M. Commissioner of the East Africa Protectorate, or the said Crown Agents on his behalf, subject the same to such charge. Holder: Lieut. R. C. Bayldon, Nairobi British East Africa Protectorate. The above is an equitable charge to operate pending the issue of the debentures.

£6,000 6 per cent. first mortgage debentures, created July 24th, 1907, and dated May 29th, 1908, have been registered. Property charged: The company's undertaking and property, present and future, including uncalled capital, but excluding *(a)* £1,500 deposited in the joint names of the Crown Agents for the Colonies and the National Bank of India, Ltd., *(b)* uncalled capital on 10,000 preference and 6,000 ordinary shares of £1 each, and *(c)* a contract dated July 26th, 1906, and power conferred thereby, save so far as the company shall hereafter, with the previous consent in writing of the Commissioner for the East Coast Protectorate or the said Crown Agents on his behalf, subject to the same to such charge. No trustees.

Issue on May 27th of £300 debentures, part of series created April 8th, 1908, to secure £4,000. Property charged: As above. No trustees. No previous issue of same series.

A memorandum of satisfaction in full of 5 script certificates, 4 dated October 30th, 1907, and 1 dated April 23rd, 1908, securing £5,450, has also been filed.

Longstreths, Ltd. (Accumulator makers, Battersea), (64,823).—£2,900 5 per cent. debentures created and dated April 30th, 1908, charged on the company's undertaking and property, present and future, including uncalled capital, have been registered. No trustees.

National Rail and Tramway Appliances Co, Ltd. (Liverpool), (72,375).—Particulars of £1,000 debentures, created by resolutions of February 21st and March 12th, 1908, have been filed pursuant to Sec. 14 (4) of the Companies' Act, 1900. Property charged: The company's undertaking and property, present and future, including uncalled capital. No trustees. The debentures are issued as collateral security for the moneys owing on a mortgage dated November 20th, 1905.

Electrolytic Alkali Co., Ltd. (Middlewich), (64,360).—Issue on April 25th of £250 and on May 2nd of £100 debentures, part of series created July 9th, 1904, to secure £50,000, charged on the company's undertaking and property, including uncalled capital. Trustees: Liverpool Mortgage Insurance Co., Ltd., 6, Castle Street, Liverpool. Previously issued of same series: £36,550.

Bude Electric Supply Co., Ltd. (95,137).—Issue on May 4th of £1,800 5 per cent. mortgage debentures, part of series created April 14th, 1902, to secure £1,500, charged on the company's undertaking and property, present and future, including uncalled capital. No trustees. No previous issue of same series.

City of Santos Improvements Co., Ltd. (14,430).—A trust deed, dated May 6th, 1908, to secure £260,000 debentures, has been registered. Property charged: *(a)* Certain concessions known as the "Tramway," "Electricity" and "Sao Vicento" concessions, as a specific first charge (subject, as regards the tramway concessions, to a debt of 600 contos of reis owing to the Federal Government of Brazil), and ranking in priority to certain debentures issued in 1899. *(b)* The company's undertaking and property, present and future, including uncalled capital, and gas and water concessions, the same to be a floating security, subject to the 1899 debentures. Trustees: Capt. C. S. Schrieber, Marlesford Hall, Wickham Market, and A. P. Henderson, 28, Austin Friars, E.C.

Guildford Electricity Supply Co., Ltd. (36,725).—Re-issue on April 30th of £500 5 per cent. first mortgage debentures, part of series created November 21st, 1905, to secure £25,000, charged on the company's undertaking and property, present and future, including uncalled capital. No trustees. Previously issued of same series: £25,000.

Howard Asphalt Troughing Co., Ltd. (formerly Howard Conduit Co., Ltd.), (69,270).—This company's annual return was filed on April 9th, when 1,007 ordinary and 1,000 deferred shares had been taken up out of a nominal capital of £20,000 in 19,000 ordinary and 1,000 deferred shares of £1 each; £7 has been received, and £2,000 is considered as paid. Mortgages and charges: Nil.

Melton Mowbray Electric Light Co., Ltd. (53,018).—This company's annual return was filed on April 1st, when 4,000 shares had been taken up out of a nominal capital of £25,000 in £5 shares. £20,000 has been received. Mortgages and charges: £20,000.

County of Durham Electrical Power Distribution Co., Ltd. (61,591).—This company's annual return was filed on March 28th, when the entire capital of £500,000 in 50,000 preference and 50,000 ordinary shares of £5 each had been taken up and paid for in full. Mortgages and charges: £219,643.

British Railway Traffic and Electric Co., Ltd. (74,227).—This company's annual return was filed on May 13th, when 70,000 shares had been taken up out of a nominal capital of £100,000 in £1 shares. £1 per share has been called up on 100, and 10s. per share on 69,900, resulting in the receipt of £35,050. Mortgages and charges: Nil.

St. Helens Cable and Rubber Co., Ltd. (87,774).—A trust deed dated April 29th, 1908, to secure £100,000 debenture stock, has been registered. Property charged: Freehold hereditaments at St. Helens, leasehold hereditaments at St. Helens and Warrington, and the company's undertaking and property, present and future, including uncalled capital, subject to a certain indenture dated December 20th, 1906. Trustees: T. O. Callender, Hamilton House, Victoria Embankment, W.C., and D. Sinclair, Prescot, Lancs.

Electric Lighting and Traction Co. of Australia, Ltd. (63,334).—This company's annual return made up to April 20th has been filed. 4,834 ordinary and 30,000 preference shares had been taken up out of a nominal capital of £300,000 in 30,000 ordinary and 30,000 preference shares of £5 each. £5 per share has been called up on 2,003 ordinary and 30,000 preference shares, resulting in the receipt of £160,015. £14,155 is considered as paid on 2,831 ordinary. Mortgages and charges: £180,000 debentures and £125,000 bank loans.

Metropolitan Electric Supply Co., Ltd. (25,395).—This company's annual return was filed on April 7th, when 200,000 ordinary and 76,121 preference shares had been taken up out of a nominal capital of £1,500,000 in 200,000 ordinary and 100,000 preference shares of £5 each. £5 per share has been called up on 195,936 ordinary and 76,121 preference shares, resulting in the receipt of £1,360,285. £20,320 is considered as paid on 4,064 ordinary shares. Mortgages and charges: £468,000.

Direct Spanish Telegraph Co., Ltd. (6,732 C).—This company's annual return was filed on April 14th, when 12,931 ordinary and 6,000 preference shares had been taken up out of a nominal capital of £95,000 in 13,000 ordinary and 6,000 preference shares of £5 each. £94,655 has been paid. Mortgages and charges: £30,000 first and £8,000 second mortgage debentures.

CITY NOTES.

Brush Electrical Engineering Co., Ltd.

THE directors' report for the year ended December 31st, 1907, states that effect has been given in the balance-sheet to the reduction of capital approved by the shareholders in August, 1907, and sanctioned by an order of the court dated April 4th, 1908. The amounts standing to the credit of the general reserve and depreciation reserve funds, as well as the balance of profit brought forward from the year 1906, have also been absorbed. The patents and goodwill account is now represented by the round figure of £100,000, while the company's investments, which were entered in the 1906 balance-sheet at £164,522, now stand at £101,335. The general profit and loss account shows a gross profit of £63,294. After debiting general charges and maintenance, the amount carried to net profit and loss account is £32,294, and after paying debenture and other interest, the net balance is £10,229. Consistently with the character of the present balance-sheet, which is essentially one of reduction and adjustment, the directors recommend that this balance be applied to initiate a new general reserve fund. The output from the works during 1907 has been the largest in the history of the company, but the directors regret that the profits realised have not been commensurate. This is chiefly due to the fact that competition in the electrical engineering industry continues to be very keen, while the after effects of the strike at the company's Loughborough Works have been severely felt. The company has also suffered in its operations by the lack of adequate working capital. The contracts upon which it has been engaged have involved a large lock-up of money while in progress, and this situation has had to be met by temporary loans from bankers and others, which, owing to the financial stringency that prevailed for so long a period during 1907, carried a high rate of interest. A portion of these loans was obtained from the British Electric Traction Co., Ltd., without security, and as part of the arrangement then made, the directors have waived their option to call upon the British Electric Traction Co., Ltd., to accept £2 ordinary shares at par in satisfaction of the advance of £30,740 made by that company in 1901, and have agreed to repay the said advance by 12 half-yearly cash instalments commencing in January, 1909, and carrying interest at the rate of 3½ per cent. per annum. With a view to placing the company in a position to carry on its business under more favourable and economic conditions, the directors put forward in January last a scheme to consolidate the existing £250 000 first and second debenture stocks, and to make a further issue of £100,000 4½ per cent. debenture stock. This proposal, however, was not supported by the first debenture stockholders, and the directors have now arranged to make an issue of £125,000 5 per cent. prior lien debenture stock, which will be specifically secured upon the freehold and leasehold lands, buildings and fixed plant of the company at Loughborough. The reduction of capital embodied in the present balance-sheet makes the company's preference and ordinary shares of the face value of £1 6s. 8d. In order to arrive at a more marketable denomination it is proposed to sub-divide these shares into shares of 6s. 8d. each, and to consolidate every three of the latter into one £1 share, thus giving the shareholders four £1 shares for every three shares at present held. Similarly the unissued 74,268 ordinary shares of £2 each will be converted into 148,536 ordinary shares of £1 each. An extraordinary general meeting is to be held to consider, and, if thought fit, adopt resolutions to give effect to such sub-division. Subject to these resolutions being confirmed, a further meeting will be required for the purpose of consolidation and completion of these proposals. The directors have decided to give the preference shareholders the right to convert 25 per cent. of their holding into ordinary shares. Any shareholder desiring to do this is requested to give notice to the secretary of the company on or before June 15th, 1908, after which the necessary steps will be taken to give effect thereto.

Aron Electricity Meter, Ltd.

THE directors' report for the six months to March 31st, 1908, shows, after providing for general charges and depreciation, a net profit of £11,486, making, with the balance brought forward, of £6,228, a total available profit of £17,714. The directors recommend the payment of a further dividend of 7 per cent. on the preference shares amounting to £3,743, and a transfer to the reserve towards goodwill and patents of £5,000, leaving to be carried forward

£3,971. A further progress of trade in all the company's branches is recorded. The satisfactory results during the half-year are ascribed to an increased demand in all European countries for the company's meters and clocks. The factories continue to be fully employed, and have again been added to in order to cope with the increased business. The company have recently placed on the market a taximeter which has been approved by the Commissioner of Police and passed by the National Physical Laboratory, and it is hoped that this new enterprise may prove an additional source of income to the company in the near future.

Anglo-Portuguese Telephone Co., Ltd.

THE twenty-first ordinary general meeting of this company was held on Thursday, June 4th, at 31, Badge Row, E.C., under the chairmanship of Mr. Herbert Allen.

In moving the adoption of the report (see ELECTRICAL REVIEW, May 29th, p. 921), the CHAIRMAN said that the gross revenue for the year from every source was £39,695, an increase on the previous year of £5,604, whilst the working expenses all told were £21,506, an increase of £3,146. The gross profit was £18 189, an increase of £2,458. Deducting royalties paid to the Portuguese Government—£1,103 as against £958; debenture interest, £2,426; and £1,155 set aside for the debenture sinking fund, the net profit was £13,089 in comparison with £10,696 for the previous year. This was an increase of £2,393, or about 22½ per cent. Their business was in no way impaired by the political events of which they had read in the papers, and the gravity of which was not minimised in the process of reporting. The national excitement arising out of the terrible tragedy in February gave the staff plenty of work and put a severe strain upon the service generally, but they were quite equal to the occasion, and the excellence of their service was freely acknowledged alike by the Press and the public of the two cities which they served. He was glad of that opportunity of thanking the managers in Lisbon and Oporto and the general staff of the company for the services rendered by them throughout the year. One of the remarkable features of the situation in Portugal during the past year had been the comparative steadiness of exchange between that country and London, all through the crisis, and they could only hope for the best in this respect during the current year. Nevertheless, they had thought it prudent to insure against contingencies in this connection, and had already bought bills sufficient to cover their remittances for the next 12 months or so. Further, they had taken out policies at Lloyd's covering them as far as possible against every conceivable risk of loss arising out of any political events that might occur in Portugal. They had also covered themselves against earthquake, and, anticipating the decision of the courts in regard to the Jamica earthquake litigation, they had in these policies covered the additional risk of fire following upon earthquake which was not covered by an ordinary fire insurance policy. All this was not done for nothing, and the premiums being all charged to revenue naturally tended to make the expenses of the company somewhat heavier than they otherwise would be. As to working expenses, he would like to say that he had made a careful analysis and comparison of the accounts of the other Anglo foreign telephone companies, and was glad to find that the comparison was by no means unfavourable to this company. Telephone business differed from most other commercial enterprises, inasmuch as often a certain point was reached in the number of subscribers to an exchange. The increase in business brought with it a more than proportionate increase of operating cost. Having regard to all the circumstances under which the business of the company was conducted, he did not think it would be prudent to anticipate over any appreciable period a lower ratio of expense than about 50 per cent. of the receipts. The extension of the underground works in Lisbon had been put in hand. This was, of course, a costly operation at the outset, but it was distinctly remunerative and otherwise advantageous in the long run as it tended to both efficiency and economy, and, moreover, diminished the risk of interruptions to the service and of the loss by material damage. During the year they had spent nearly £9,000 on capital account which was within £700 of what they spent last year, but they had been able to do this without encroaching in any way upon their reserve working capital of £10,000 which still remained intact. It was really the reserve fund, or surplus reserve moneys that they used for this purpose, and the extension of their own business was, the board considered, the most remunerative purpose to which they could apply that fund. This was the third year in succession that they had set aside from the profits £5,000 to reserve or contingency fund, and at the present moment this fund would have been £35,000 instead of £15,000, but for the fact that three years ago they wrote down their capital expenditure by the transfer of £20,000 from the reserve fund to capital account. The principal work completed during the year was the extension of the switchboards at Lisbon and Oporto, giving an increased capacity of 900 subscribers in the former city, and for 240 in the latter. By the end of the current year, further extensions would have to be made. The total number of calls recorded in both cities during the year was 7¾ millions, giving an average of 1½d. per message. With regard to the final dividend of 5 per cent., which made 8 per cent. for the year, the board had taken into full consideration every possible circumstance, both present and future, so far as the future could be foreseen. In the matter of finance, they on the board were a very conservative body, with a tendency to understate rather than overstate their case, and the shareholders could rest assured that they would not have advanced the dividend beyond 7½ per cent., which at one time he was disposed to regard as their maximum, unless they had felt very strongly that the step was justified. It seemed to have been a sort of unwritten law in the past that telephone dividends should not exceed 7 or 7½ per cent., but recently there had been several departures beyond this limit. His own view, however, was that whatever their prosperity, they should not look for a distribution exceeding 8 per cent.—that was if they were to build up such a reserve fund as was essential in a telephone company's business. In conclusion, the chairman said they were nearly half way through another year, and there was little sign of curtailment in the growth of revenue, but, of course, they could not go on indefinitely piling increase upon increase. He was reminded the other day that the company was originally promoted by the Consolidated Electrical Co., Ltd., the pioneer of so many telephone undertakings, and that company was still deeply interested in their welfare.

MR. F. W. KERR seconded the motion.

Several shareholders congratulated the board on the successful progress of the company, and MR. HIBBERT suggested that instead of placing so much to reserve a higher dividend might be declared.

The CHAIRMAN said it would be an unwise policy to neglect the reserve fund. The concession ran out in 1837, and in view of this and the fact that the reserve fund was practically the depreciation fund, they ought to strengthen it in every way possible.

The report was then agreed to.

Durham Collieries Electric Power Co., Ltd.

THE directors' report, which was submitted to the meeting held at Basildon House, Moorgate Street, E.C., on the 2nd inst., covered a period of two years from March 31st, 1906, which was the date of the previous balance-sheet. The trading account covers the period during which the power station has been in operation. The gross profit and the compensation referred to below have sufficed to cover the ordinary working expenses of the company. The loss shown by the profit and loss account is attributable to interest on debentures and temporary loans, required in consequence of the subscribed share capital having been insufficient to meet the cost of completing the enlarged undertaking. The results hitherto attained form no adequate measure of those to be expected after the full load provided for by existing contracts is reached. In the early part of 1907, the arrangements for raising more capital on debentures, which had been pending for several months, were carried to completion, and an issue of £150,000 5 per cent. first mortgage debentures was successfully made. The whole of these debentures were subscribed for, and have now been paid up in full. At the same time 28,367 preference shares and 5,000 ordinary shares were offered to the existing shareholders in proportion to their holdings. The response received from shareholders was, however, very small. Shortly before the issue of the debenture prospectus, an agreement was entered into with the Newcastle-upon-Tyne Electric Supply Co., Ltd., by which that company undertook to operate this company's power station upon favourable terms for a period of 42 years. On April 1st, 1907, the agreement came into force, and has since that date been working satisfactorily, and secures a fair rate of gross profit upon the output. This arrangement was followed up in June, 1907, by an agreement with the Newcastle Co., under which, at its expense, the whole of this company's plant was to be made capable of working in unison with that of the Newcastle Co. by being converted from a periodicity of 50 cycles per second to one of 40 cycles. The conversion was an operation of considerable magnitude, and although it has been carried on without intermission, it was only during February of the present year that the changing over of the principal portions of the machinery was completed, and even now some minor changes have to be made. The effect of the change of frequency, essential as it was under the altered circumstances of the agreement for working in harmony with the Newcastle Co., instead of in competition with it, was that the electrical plant of the colliery companies, who are, and will be, the company's largest customers, had also to be converted. While this was being done, the increase in the output from the station, and the development of a paying load were necessarily kept back, with the result that the growth of the company's revenue has been correspondingly retarded. By way of compensation for this delay, the Newcastle Co. has paid a sum of £6,000. The Newcastle Co. has agreed to install, at its own expense, generating plant which will almost double the capacity of this company's generating station, and agreements have been made which provide for the laying of mains to supply this company's customers. An important main is now being laid by the County of Durham Electrical Power Distribution Co., Ltd., at its own expense, upon the cost of which this company will pay interest. A further agreement has now been entered into with the Newcastle company, under which it will operate the distribution system as well as the generating plant. This agreement is subject to the ratification of the shareholders of this company, and was submitted at the ordinary general meeting. The result of this and other arrangements which have been made, including a delimitation of area of supply, is that the Newcastle company and its associated companies, which might have been formidable competitors, have become powerful allies, and that the systems can now be worked as a harmonious whole, to the great advantage of the revenue of all companies concerned, and of the efficiency and regularity of the supply to customers. The prospects of a large increase in the company's business in the near future are good, inasmuch as consumers have now nearly completed the adaptation of their plant, and are from time to time installing new electrical machines with a view to the more complete electrification of their collieries. The

effect is not only to increase the consumption of current, but to greatly improve the average load. Inquiries have been received from other neighbouring collieries, and negotiations for the supply of electricity to fresh important undertakings are in progress. The balance-sheet shows that a considerable sum of money is required before this company can discharge its existing liabilities, and it is also necessary to make provision for extensions of the plant and distribution system, which will undoubtedly be needed as the business continues to expand. The confidence which the directors feel in the future of the undertaking, provided it is equipped with sufficient funds, is endorsed by the fact that the Newcastle Co. and its associated concerns have already undertaken large responsibilities under existing agreements, and that the Newcastle Co. is prepared to undertake further liabilities, under the above-mentioned agreement, for operating this company's distribution system. It is now proposed that an issue of £100,000 6 per cent. second mortgage debentures should be created, and that £50,000 of these should be issued with the least possible delay. Resolutions increasing the company's borrowing powers, and authorising the creation of these debentures, will be submitted to an extraordinary general meeting. The directors have elected Mr. A. W. Tait, a partner in the firm of Messrs. George A. Touche and Co., to a seat on the board.

Sir Douglas Fox presided at the meeting. In moving the adoption of the above report, he said that he did so with somewhat mixed feelings. They had had a very troublous time since the last meeting, having had to deal with very difficult and very special circumstances. They had also been met with a difficulty which was quite unexpected to them until it arose, that was the voluntary suspension of their contractors, Messrs. Bruce Peebles and Co., Ltd. It also became clear that if they were to make the company a success, it was absolutely necessary to enter into friendly relations with the Newcastle Co, who held the Parliamentary powers in their district, instead of treating them as competitors, and keeping them at arm's length. They, therefore, entered into arrangements with them by which they undertook to operate their station, but difficulty arose because of the frequency. The frequency of their machinery was (he thought very wisely at the time) fixed at 50 cycles for independent working, but when they made up their minds that it was best policy to associate themselves in a friendly way with the Newcastle Co., it became necessary that the machinery should be placed in direct connection with theirs, and for that purpose it was essential to change it over from 50 to 40 cycles. It was this change that had involved them in the great delay, and therefore the paying load that they anticipated had not come as rapidly as it would otherwise have done. At the time the agreement was made their own machinery was practically completed, and a great deal of their customers' machinery was also in a forward state. The consequence was that not only had their own station to be changed over, but the operating plant of the different collieries also had to be for the reduced number of cycles. The Newcastle Co. under the agreement were expending large sums of money to add to the power at Philadelphia station and to change over from 50 to 40 cycles. Under other circumstances their anticipations that some time last year a paying load would have been reached, would have been fulfilled. At present they were well into between ten and eleven millions of units, and that was increasing rapidly each month. When they had arrived at 18 millions they would be in a fairly satisfactory position. This was the dark side of the case, but they had kept up their courage, because they knew that the company was founded upon a thoroughly sound calculation as to its commercial value when its contracts were carried out. The Newcastle Co. would work them at a rate which gave a certainty of a reasonable profit. The contracts with the Newcastle Co. were now very extensive. First of all they covered the operations of the Philadelphia Station, and that was followed by the operation of their transmission lines. They had now been extended again to deal with the lighting under their auxiliary company — the Houghton-le-Spring Electric Lighting Co., so that now the whole of their operations in connection with the company would be in the hands of the Newcastle Co. as their contractors to work it at certain fixed rates.

Mr. A. W. Tait, who had lately joined the board, in referring to the proposed creation of debentures to be issued as required for the development of the system, said that the terms of the issue had not yet been definitely fixed upon. In reply to a shareholder who asked why the contractors appeared on the balance-sheet as debtors, he said that that was due to the fact that during the progress of the contract, sums were paid to the contractors on account, and when the contract came to be finally completed, the amount had been overpaid, and the final balance could not yet be certified because the engineer refused to certify certain portions of it. They might have to go to arbitration, as provided under the contract. The liquidation of the contractors made it impossible for this company to recover the debt, at least in cash. What proposals Bruce Beebles would make they could not at the moment say. Bruce Peebles, as Bruce Peebles, did not admit the figure that the directors of this company considered a fair one.

The Chairman added that certain of the machinery that was supplied under the contract turned out unsatisfactory, and they were bound to debit the contractors with it. If they had not gone into liquidation they would have had to replace that machinery.

The report was adopted.

After the other business had been transacted, various other meetings were held authorising the raising of the new debentures, and making certain changes in the articles.

The Paris Metropolitan Railway.

The report of the Compagnie du Chemin de Fer Métropolitain de Paris for 1907, which was approved at the general meeting held on May 12th, first refers to the underground tunnel, and incidental extension works executed by the municipal authorities during the year, and to the works carried out by the company in regard to the permanent way, railway stations, sub-stations, the laying of feeders, and the establishment of workshops. At the end of 1907 the rolling stock comprised 365 motor coaches, and 415 trailers, making a total of 780 coaches. Dealing with the works in progress, or in preparation, the report states that the company continues to take into consideration the question of the provision of additional or safety exits in connection with those stations where the density of traffic renders this necessary, and schemes in relation to six stations have been submitted for the approval of the authorities. Apart from the supply of current from the power station of the Société d'Electricité de Paris, at Saint Denis, the company is still making improvements in connection with its generating station at Berey, and a second tunnel for the accommodation of the cable network has become necessary. The question of the ventilation of the existing underground tunnels, to which reference was made in the report for 1906, has resulted in the preparation of projects for the formation of openings at 12 stations, and 10 of these have now received official sanction. As to the erection of lifts at various stations, approval has been given to the establishment of vertical lifts at the stations of the Place de la Republique and Boulevard Barbès-Boulevard Rochechouart, whilst a mechanically operated staircase is to be established at the Père-Lachaise station. The rolling stock in course of construction on January 1st, 1908, comprised 190 motor coaches and trailers, of which 58 have been delivered, and further batches of 194 have been ordered since the beginning of the year, all being of the bogie type and built of steel. The financial position may be summarised as follows:—

	1907.	1906.
Share capital	£3,000,000	£3,000,000
Bonds	£1,890,000	£94,000
Gross receipts	£1,387,200	£1,171,800
Cooking expenses	£598,200	£502,400
Municipal share in receipts.. ..	£449,000	£376,000
Net profits	£340,000	£273,960
Dividend, per cent.	7½	7½
Number of tickets issued	194,823,282	165,813,216

The company has a legal reserve fund amounting to £52,000, and a general reserve fund totalling £91,700. During 1907 the average mileage in operation was 25½ miles, and the service of trains and the number of coaches forming each train were varied according to the daily needs of the passenger traffic and the time of the year. The number of employés of all grades advanced from 3,404 in 1906, to 3,630 at the end of 1907, and the system of bonuses granted to the different classes in order to enhance the working of the railways was maintained and developed. The amount appropriated for these payments reached £16,148, or £4,600 in excess of those paid in 1906. During the year the company redeemed 4,040 £10 shares, and the issue of 3½ per cent. obligations was increased by an emission of 50,000 4 per cent. bonds of £20 each. The report also gives details of the agreement entered into for an interchange of traffic with the Nord-Sud underground electric railway, which is now in course of construction.

Birmingham and Midland Tramways, Ltd.—The report for 1907 states that the total revenue for the year from all sources amounted to £83,837, compared with £92,582 for 1906, but the latter figure included the receipts for the first six months of the year of the Dudley Road Tramway in Birmingham, which has since passed into the hands of the Corporation. The expenses for the year were £38,652, against £44,951. After providing for all expenses chargeable to revenue, including rents, repairs and maintenance, placing £1,500 to depreciation and renewals accounts, and adding the £552 brought forward from the last account, there remains £44,236. According to the *Financial Times*, the directors propose to place to the debenture redemption fund £3,550, to pay a dividend on the preferred ordinary shares at the rate of 4 per cent. for the year ended December 31st, 1907 (less tax), and to carry to next account £83. The total expenditure on capital account during the year amounted to £24,820, and included the completion of the car-sheds and workshops at Tividale, the Bearwood Road sub-station and additional plant and cables in connection with the development of the electric light undertaking.

Stock Exchange Notice.—Application has been made to the Committee to appoint a special settling day in and to grant a quotation to:—Metropolitan Electric Tramways, Ltd.—Further issue of £173,800 4½ per cent. debenture stock.

Canadian General Electric Co.—The directors have declared a dividend of 1¾ per cent. on the Common stock for the three months to June 30th, being at the rate of 7 per cent. per annum.

New Issue.—It is stated in the *Times* that arrangements are being made for an issue of about £250,000 West Kootenay Power and Light 6 per cent. debentures, which will be offered at 103.

Mexican Light and Power Co.—A dividend of 1 per cent. on the out-standing ordinary shares has been declared.

MARKET QUOTATIONS.

Wednesday, June 10th.

CHEMICALS, &c.		Latest Price.	Fortnight's Inc. or Dec.
a Acid, Hydrochloric	per cwt.	5/-	..
a ,, Nitric	per cwt.	22/-	..
a ,, Oxalic	per cwt.	33/-	..
a ,, Sulphuric	per cwt.	5/6	..
a Ammoniac, Sal	per cwt.	42/-	..
a Ammonia, Muriate (crystal) ..	per ton	£33 10	..
a ,, ,, ...	per ton	£30	..
a Bleaching powder	per ton	£5 10	..
a Bisulphide of Carbon	per ton	£18	..
a Borax	per ton	£16	..
a Copper Sulphate	per ton	£22	£2 dec.
a Lead, Nitrate	per ton	£28	..
a ,, White Sugar	per ton	£27	..
a ,, Peroxide	per ton	£33	..
a Methylated Spirit	per gal.	2/6	..
a Potassium Bichromate, in casks	per lb.	8½d.	..
a Potash, Caustic (75/80 %) ..	per ton	£30	..
a ,, Chlorate	per lb.	8½d.	..
a ,, Perchlorate	per lb.	9d.	..
a Potassium Cyanide	per lb.	7d.	..
a Shellac	per cwt.	130/-	20/- inc.
a Sulphate of Magnesia	per ton	£4 10	..
a Sulphur, Sublimed Flowers ..	per ton	£6 10	..
a ,, Recovered	per ton	£5 10	..
a ,, Lump	per ton	£5	..
a Soda, Caustic (white 70 %) ..	per ton	£12 15	..
a ,, Chlorate	per lb.	8½d.	..
a ,, Crystals	per ton	£3 5	..
a Sodium Bichromate, casks ..	per lb.	5½.	..
a ,, Cyanide (basis 100 %) ..	per lb.	7d.	..
METALS, &c.			
b Aluminium Ingots, in ton lots ..	per ton	£87	..
b ,, Wire, in ton lots ..	per ton	£136	..
b ,, Sheet, in ton lots ..	per ton	£134	..
c Babbitt's metal ingots	per ton	£50 to £130	..
c Brass (rolled metal 2" to 12") basis	per lb.	7¼d.	..
c ,, Tube (brazed)	per lb.	8¼d.	..
c ,, ,, (solid drawn)	per lb.	7¾d.	..
c ,, Wire, basis	per lb.	6¾d.	¼d. dec.
c Copper Tubes (brazed)	per lb.	9¼d.	..
c ,, ,, (solid drawn) ..	per lb.	9¼d.	..
g Copper Bars (best selected) ..	per ton	£71	£2 dec.
g Copper Sheet	per ton	£71	£2 dec.
g ,, Rod	per ton	£71	£2 dec.
c ,, (Electrolytic) Bars ..	per ton	..	..
c ,, ,, Sheets ..	per ton	..	..
c ,, ,, Rod ..	per ton	..	..
c ,, ,, H.C. Wire ..	per lb.	..	..
f Ebonite Rod	per lb.	3/8	..
f ,, Sheet	per lb	8/-	..
m German Silver Wire	per lb.	1/6½	..
h Gutta-percha, fine	per lb.	5/6 to 6/6	..
h India-rubber, Para fine	per lb.	3/7	..
i Iron Pig (Cleveland warrants) ..	per ton	..	..
l ,, Wire, galv. No. 8, P.O. qual.	per ton	£14 5	..
g Lead, English Ingot	per ton	£18	..
m Manganin Wire No. 28	per lb.	8/-	..
g Mercury	per bot.	£8 2 6	..
d Mica (in original cases) small ..	per lb.	6d. to 1/-	..
d ,, ,, ,, medium	per lb.	2/6 to 4/-	..
d ,, ,, ,, large ..	per lb.	4/6 to 8/6	..
p Phosphor Bronze, plain castings	per lb.	1/- to 1/1½	..
p ,, rolled bars & rods	per lb.	1/2 to 1/8	..
p ,, ,, strip & sheet	per lb.	1/2½ to 1/5	..
o Platinum	per oz.	100/-	..
e Silicium Bronze Wire	per lb.	..	..
r Steel, Magnet, in bars	per ton	£55	..
g Tin, Block (English)	per ton	£129 to £130	..
n ,, Wire, Nos. 1 to 16	per lb.	1/10	..
p White Anti-friction Metals— "White Ant" brand	per ton	£34 to £58	..
k Zinc, Sh't (Vieille Montagne brd.)	per ton	£21 10	10/- dec.

Quotations supplied by:—

a G. Boor & Co.
b The British Aluminium Co., Ltd.
c Thos. Bolton & Sons, Ltd.
d F. Wiggins & Sons.
e Frederick Smith & Co.
f India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.
g James & Shakespeare.
h Edward Till & Co.
i Bolling & Lowe.
k Morris Ashby, Ltd.
l Richard Johnson & Nephew, Ltd.
m W. T. Glover & Co., Ltd.
n P. Ormiston & Sons.
o Johnson, Matthey & Co., Ltd.
p The Phosphor Bronze Co., Ltd.
r W. F. Dennis & Co.

Tramways and Light Railways Estates, Ltd.—The credit balance for the year 1907 was £587, out of which £100 is placed to reduction of goodwill account, a 3 per cent. dividend is paid on the shares, and £186 is carried forward.

R. Waygood & Co., Ltd.—The report for the year ended March 31st states that the profits, including £3,068 brought forward, amount to £26,544. The directors recommend a further dividend at the rate of 7 per cent. per annum, making 6 per cent. for the year on the ordinary shares. £3,544 is carried forward.

France.—The report of La Compagnie Francaise pour l'Exploitation des Procedes Thomson-Houston, of Paris, reports a profit of £111,036 for the last financial year. A dividend of 5½ per cent. is being declared, the same as in the preceding 12 months.

STOCKS AND SHARES.

Tuesday Evening.

MARKETS have been naturally interrupted by the Whitsun Holidays. (In consequence—in parenthesis—there is not much to write about in this column.) Nevertheless, prices of investment securities have remained firm, and the steady advance in prior-charge stocks of industrial companies remains a market feature.

Railway Ordinary stocks are attracting more notice than usual, and the Great Northern-Great Central-Great Eastern working agreement has led to anticipations of other companies pursuing a similar policy. The way in which the various Tube railways are now inter-working has given rise to speculations as to whether the bonds of friendship cannot be drawn still more closely, but this is mere theorising, and, so far as can be ascertained, has no foundation in negotiation.

Prices are quiet. Central Londons and City and South London Ordinary stocks have hardly moved. Central London 4 per cent. Debenture advanced to 103½ and Bakerloo Debenture to 90½. District stock slipped back to 14¼, after rising to 15, and Metropolitan Consolidated weakened to 42½. The latter company's surplus land stock, however, is better. The Franco-British Exhibition is turning out successfully, but just lately it has been the turn of the omnibus companies to benefit from speculative purchases of their stocks and shares.

London United Tramways Debenture improved, and the tramway section on the whole has retained a hard tone. The Anglo-Argentine Second Preference are the centre of a good deal of business, and activity is also noticeable in the case of the Mexico Tramways. Good rises have occurred in the stocks of the Mexican Light and Power Co., the Common advancing to 57½ and the bonds to 87½.

City of London Preference added ¼ to their price, and Urban Preference rose ½ to 2; otherwise, the list is uninteresting. Good authorities hold out slender hope of the electrical supply shares advancing on this side of the autumn. The argument which meets with most support, in favour of the market, says that prices of the best shares have fallen to levels that discount most of the misfortunes which have already befallen, or are still likely to befall, the industry. Unhappily, there are still unknown quantities, the effects of which are impossible to foresee.

The Brush Electrical Engineering report is a document voluminous, interesting, and—painful. Its details are set out upon another page, and they fully explain the hapless state into which the market for the company's securities has fallen. An issue of £125,000 5 per cent. prior lien Debenture stock is proposed, and the nominal value of the shares is to become, by an ingenious arrangement, £1. The new issue is to be in lieu of that which would have been made if the directors' plan to consolidate the first and second Debenture stocks had been carried, because this scheme involved the further issue of £100,000 4½ per cent. Debenture stock. It remains to be seen whether the latest suggestion will meet with any more support at next Tuesday's meeting than the last, abortive, scheme enjoyed at the meetings convened to pass it.

Aron Electricity Meter Preference hardened to 15s. 6d. upon the publication of a report which shows the company to be making excellent progress; 7 per cent. dividend is declared on account of arrears.

Manufacturing shares, on the whole, are steady, but British Aluminium Ordinary slipped back 5s. to 3½. Babcock & Wilcox Ordinary improved to 3⅞ and Telegraph Constructions to 30½.

Telegraph and telephone issues retain pronounced strength. The chief demand still runs upon the Debenture stocks, some of which are becoming difficult to secure. In the speculative list, Anglo-American Telegraph Deferred recovered to 17 after being ½ lower. Globe Telegraph Ordinary followed the rise of the market. National Telephone stocks are harder in several cases.

Thomas Parker, Ltd.—Our Wolverhampton correspondent writes:—"A meeting of shareholders was held a short time ago, and after discussion it was decided to reconstruct the company. It is stated that the new company, while still retaining the old directorate, will be extended, and that several additions will be made to the board. Thomas Parker, Ltd., will disappear, and the new concern will in all probability be designated 'The Rees-Roturbo Pump, Ltd.' The business of the new firm will be mainly devoted to the manufacture of the 'Rees-Roturbo' pumps, instead of being confined to electrical machinery as hitherto. The proposed absorption of the old firm is one of the results of the successful developments of the new pump. The changes proposed will necessitate an increase in the present number of employés, and the addition of new machinery." The last report of the company appeared in the ELECTRICAL REVIEW for July 26th, 1907, page 143.

SHARE LIST OF ELECTRICAL COMPANIES.

TELEGRAPH AND TELEPHONE COMPANIES.

Present Issue.	NAME.	Stock or Share. *	Dividends for the last four years. 1904.	1905.	1906.	1907.	Closing Quotations June 2nd.	Closing Quotations June 9th.	Business done week ended June 9th, 1908. Highest.	Lowest.	Rise + or Fall —	Present Yield per cent. £ s. d.
25,000	Amazon Telegraph Co.'s shares, Nos. 1 to 25,000	10	Nil	Nil	Nil	Nil	2 — 3	2 — 3	..	..	..	Nil
143,300	Do. do. 5 % Debs., Nos. 1 to 1,250 Red.	100	Nil	5 %	5 %	5 %	84 — 87	84 — 87	..	..	..	5 14 11
$131,561,400	American Telephone & Telegraph, Cap. Stock	$100	7¼%	7¼%	8 %	8 %	118 —123	118 —122	..	..	..	6 11 2
58,000,000	Do. Collat. Trust, 4% Bonds, 1 to 28,000 and 53,001 to 78,000	$1000	4 %	4 %	4 %	4 %	87 — 90	88 — 91	89½	87½	+1	4 7 11
598,180	Anglo-American Telegraph	Stock	2¾%	3½%	3¾%	3½%	59 — 62	59 — 62	..	..	..	5 12 11
3,200,910	Do. do. 6 % Pref.	Stock	5½%	6 %	6 %	6 %	104 —106	103 —105	105	103⅞	—1	5 14 3
3,200,910	Do. do. Deferred	Stock	Nil	½	1½%	1 %	17⅞ — 17⅝	16⅞ — 17½	17⅝	1c⅛	— ⅜	5 15 11
50,000	Anglo-Portuguese Tel., 6 % Mort. Deb. Stock Red.	100	..	5 %	5 %	5 %	99 —102	99 —102	..	..	..	4 18 0
44,000	Chili Telephone, Nos. 1 to 44,000	5	8 %	8 %	8 %	..	7 — 7½	7 — 7⅛	..	..	..	5 6 8
2,383,376	Commercial Cable Sting. 500 year 4 % Deb. Stk. Red.	Stock	4 %	4 %	4 %	4 %	84 — 87	84 — 87	85½	84½	..	4 12 0
16,000	Cuba Telegraph	10	5 %	5 %	5 %	..	7½ — 8½	7½ — 8½	..	..	..	6 1 3
6,000	Do. 10 % Pref.	10	10 %	10 %	10 %	10 %	15½ — 16½	15½ — 16½	..	..	..	5 19 5
12,931	Direct Spanish Telegraph, Ord.	5	4 %	4 %	4 %	4 %	3⅝ — 3¾	3 — 3½	..	..	— ⅜	6 3 1
6,000	Do. do. 10 % Cum. Pref.	5	10 %	10 %	10 %	10 %	8 — 9	8 — 9	..	..	..	5 11 1
30,000	Do. do. 4½ % Debs.	50	4½%	4½%	4½%	4½%	100—103	100 —103	..	..	..	8 14 10
60,710	Direct United States Cable	20	3½%	4½%	4½%	..	13¾ — 14	13⅝ — 14	13⅝	..	..	6 12 2
53,700	Direct W. India Cable, 4½ % Reg. Deb., 1 to 1,300, R.	100	4½%	4½%	4½%	4½%	100 —102	100 —102	..	..	..	4 8 3
4,000,000	Eastern Telegraph, Ord. Stock	Stock	7 %	7 %	7 %	7 %	130 —135	130 —135	134½	132½	..	5 3 8
2,000,000	Do. 8½ % Pref. Stock	100	8½%	8½%	8½%	8½%	83½ — 86½	83½ — 86½	..	..	..	4 0 11
1,896,706	Do. 4 % Mort. Deb. Stock. Red.	Stock	4 %	4 %	4 %	4 %	100⅛ —102⅛	100⅛ —102⅛	102	100⅞	..	3 18 1
800,000	Eastern Extension, Australasia, and China Tele.	10	7 %	7 %	7 %	7 %	12⅝ — 13⅛	12⅝ — 13⅛	12⅞	12¾	..	5 5 8
752,400	Do. 4 % Deb. Stock	Stock	4 %	4 %	4 %	4 %	100⅜ —102⅜	100⅜ —102⅜	..	..	..	3 18 1
269,700	East & S. Afric. Tel., 4 % Mt. Db., 1 to 3,000, red. 1909	100	4 %	4 %	4 %	4 %	100 —102	100 —102	..	..	..	3 18 5
200,000	Do. 4 % Reg. M. Debs. (Mauritius Sub.) 1 to 8,000	25	4 %	4 %	4 %	4 %	99 —101	99 —101	..	..	..	15 17 0
181,127	Globe Telegraph and Trust	10	5⅝%	5½%	5½%	5½%	10⅜ — 10⅝	10⅜ — 10⅝	10⅝	10⅝	+ ⅛	5 8 9
181,127	Do. do. 6 % Pref.	10	6 %	6 %	6 %	6 %	13⅜ — 14⅛	13⅜ — 14⅛	13⅝	..	..	4 4 11
150,000	Great Northern Telegraph, of Copenhagen	10	24 %	24%	20 %	20 %	27 — 29	27½ — 29½	28½	28½	+ ½	6 17 11
24,300	Halifax and Bermudas Cable, 4½ % 1st Mort. Debs., within Nos. 1 to 1,200, Red.	100	4½%	4½%	4½%	4½%	100 —102	100 —102	..	..	..	4 8 3
17,000	Indo-European Telegraph	25	13 %	13 %	13 %	13 %	52 — 55	53 — 55	53½	52½	..	6 16 4
$41,380,400	Mackay Companies Common	$100	1 %	2 %	3½%	4 %	58 — 63	60 — 70	..	..	+4½	5 14 4
$50,000,000	Do. do. 4% Cum. Pref.	$100	4 %	4 %	4 %	4 %	62 — 66	60 — 70	..	..	+6	5 14 4
884,190	Marconi's Wireless Telegraph	1	Nil	Nil	Nil	Nil	⅛ — ⅜	⅛ — ⅜	12/0	10/9	..	Nil
72,680	Monte Video Telephone Co., Ltd. Ord.	1	4 %	5 %	6 %	6 %	2⅛ — 1 3/16	2⅛ — 1 3/16	19/3	18/9	..	4 14 1
86,492	Do. do. do. 5 % Pref.	1	5 %	5 %	5 %	5 %	1 5/16 — 1 7/16	1 5/16 — 1 7/16	..	..	..	5 6 8
2,225,000	National Telephone, Pref. Stock	100	6 %	6 %	6 %	6 %	108 —110	108 —110	109⅜	108	..	5 9 1
8,725,000	Do. do. Def. Stock	100	5 %	5 %	5 %	6 %	110 —112	111 —113	113	110½	+1	5 6 2
15,000	Do. do. 6 % Cum. 1st. Pref.	10	6 %	6 %	6 %	6 %	10½ — 12½	10½ — 12½	..	..	..	4 16 0
15,000	Do. do. 6 % Cum. 2nd Pref.	10	6 %	6 %	5 %	5 %	10½ — 12½	10½ — 12½	10 3/16	10 1/16	..	4 0 0
250,000	Do. do. 5 % Non-cum. 3rd P., 1 to 250,000	5	5 %	5 %	5 %	5 %	5⅜ — 5⅝	5⅜ — 5⅝	..	..	..	4 8 11
2,000,000	Do. do. 3½ % Deb. Stock Red.	Stock	3½%	3½%	3½%	3½%	99 —101	100 —100½	..	..	..	3 9 4
1,716,598	Do. do. 4 % Deb. Stock Red.	100	4 %	4 %	4 %	4 %	101½ —103½	102 —104	..	..	+ ½	3 16 11
179,313	Oriental Telep. and Elec. 1 to 171,504, fully paid	1	6½%	7 %	7 %	8 %	1 5/16 — 1 7/16	1 5/16 — 1 7/16	..	..	..	5 17 5
50,000	Do. do. 6 % Cum. Pref.	1	6 %	6 %	6 %	6 %	1¼ — 1½	1¼ — 1½	..	..	..	4 16 0
99,100	Do. do. do. 4 % Red. Deb. Stock	100	..	4 %	4 %	4 %	90 — 93	90 — 93	..	..	..	4 6 0
99,400	Pacific & European Tel., 4 % Guar. Debs., 1 to 1,000	10	4 %	4 %	4 %	4 %	98½ —101½	99 —102	..	..	+ ½	3 18 5
11,839	Reuter's	8	5 %	5 %	5 %	5 %	7½ — 8½	7½ — 8½	..	..	..	4 14 1
99,100	Telephone Co. of Egypt, 4½ % Deb. Red.	100	..	4½%	4½%	4½%	99 —102	99 —102	..	..	..	4 8 3
3,083	Submarine Cables Trust	Cert.	6 %	6 %	6 %	6 %	127 —130	127 —130	..	..	..	4 14 4
100,000	United River Plate Telephone	5	8 %	8 %	8 %	8 %	6⅝ — 6¾	6⅝ — 6¾	..	..	..	5 16 4
40,000	Do. 5 % Cum. Pref., Nos. 1 to 40,000	5	5 %	5 %	5 %	5 %	5 — 5½	5 — 5⅜	..	..	..	4 15 3
30,008	W. Coast of America, 1 to 30,000 & 53,001 to 53,008	2	Nil	Nil	2½%	..	1⅜ — 1½	1⅜ — 1⅝	..	..	..	3 1 6
150,000	Do. 4 % Debs., 1 to 1,500 guar. by Braz. Sub. Tel.	100	4 %	4 %	4 %	4 %	99 —102	99 —102	..	..	..	3 18 5
207,980	Western Telegraph, Ltd., Nos. 1 to 207,980	10	7 %	7 %	7 %	..	13⅜ — 13⅞	13⅜ — 13⅞	13⅞	13½	..	5 0 11
800,000	Do. do. 4 % Deb. Stock Red.	100	4 %	4 %	4 %	4 %	100½ —102½	100½ —102½	101½	100½	..	3 18 1
88,321	West India and Panama Telegraph	10	Nil	Nil	Nil	Nil	1/16 — 3/32	1/16 — 1/8	13/9	12/6	+ 3/32	Nil
34,568	Do. do. 6 % Cum. 1st Pref.	10	6 %	5 %	8 %	6 %	8½ — 9	8½ — 9	..	..	..	6 13 4
4,669	Do. do. 6 % Cum. 2nd Pref.	10	Nil	Nil	Nil	£2 6 0	9½ — 10½	9½ — 10½	..	..	..	2 4 9
80,000	D do. 5 % Debs., Nos. 1 to 1,800	100	5 %	5 %	5 %	5 %	101 —104	101 —104	..	..	..	4 16 2

ELECTRICAL RAILWAY, MANUFACTURING AND INDUSTRIAL COMPANIES.

320,000	Anglo-Argentine Trams, 10 % Nom. Cum. 2nd Pref., 250,008 to 580,007	5	8 %	8 %	8 %	9 %	8⅛ — 8 1/16	8⅛ — 8 1/16	8¼	8 3/32	+ ⅛	5 5 1
260,007	Do. 6 % Cum. Prefs., 1 to 260,007	5	5½%	5½%	5½%	5⅝%	6¼ — 6½	6¼ — 6½	6⅜	6⅛	..	4 8 6
266,600	Do. Permanent, 6 % Deb. Stock, 1888	100	6 %	6 %	6 %	6 %	140 —145	140 —145	143	..	..	4 13 3
285,100	Auckland E. Trams, 5 % 1st Mort. Deb. Stock	100	5 %	5 %	5 %	5 %	104 —107	104 —107	105½	..	..	4 13 6
580,000	Babcock & Wilcox, 1 to 580,000	1	20 %	20 %	20 %	20 %	3⅜ — 3⅞	3⅜ — 4	78/1½	75/-	+ ½	5 0 0
100,000	Do. do. 6 % Cum. Pref., 1 to 100,000	1	6 %	6 %	6 %	6 %	1 1/16 — 1 1/8	1 1/16 — 1 1/8	..	..	..	3 16 10
40,000	British Aluminium, Ord., 1 to 40,000	5	7 %	7 %	7 %	7 %	3⅝ — 3¾	3 — 3⅛	86/8	85/-	— ½	10 0 0
40,000	Do. do. 7 % Cum. Pref.	5	7 %	7 %	7 %	7 %	4 — 4⅛	4 — 4⅛	..	..	..	7 15 7
20,000	Do. do. "A" 6 % Cum. Pref.	5	6 %	6 %	6 %	6 %	4⅜ — 5⅛	4⅜ — 5⅛	..	..	..	5 14 3
20,000	Do. do. 4 % Funding Certs.	5	4 %	4 %	4 %	4 %	3¾ — 4⅛	3¾ — 4⅛	..	..	..	4 14 1
288,200	Do. do. 6 % 1st Mort. Deb. Stock Red.	Stock	5 %	5 %	5 %	5 %	104 —108	104 —108	..	..	..	4 12 7
800,000	Do. do. 5½ % Loch Leven Debs.	100	..	..	5½%	5½%	97 —100	95 — 98	..	..	—2	5 12 8
400,000	British Columbia E. Rail Def. Ord. Stock	100	6 %	6 %	6 %	8 %	128 —132	127 —131	..	..	—1	5 2 2
800,000	Do. 5 % Pref. Ord. Stock	100	5 %	5 %	5 %	5 %	112 —115	108 —112	110½	110½	—3½	4 9 3
800,000	Do. 5 % Cum. Perp. Pref. Stock	100	5 %	5 %	5 %	5 %	107 —111	107 —111	..	..	..	4 19 1
283,000	Do. 4½ % 1st Mort. Debs., 1 to 6,250	40	4½%	4½%	4½%	4½%	99 —102	99 —102	102	..	..	4 8 3
220,000	Do. 4½ % Vancouver Power Debs., 1 to 2,200	100	4½%	4½%	4½%	4½%	101 —104	101 —104	..	..	..	4 6 2
133,301	British Electric Traction	10	6 %	8 %	Nil	Nil	1½ — 1⅝	1½ — 1⅝	27/6	..	..	Nil
161,497	Do. do. 6 % Cum. Pref.	10	6 %	6 %	6 %	..	3½ — 4⅜	3¾ — 4⅜	79/4½	78/1½	+ ½	12 19 6
1,473,653	Do. do. 5 % Perp. Deb. Stock	Stock	5 %	5 %	5 %	5 %	90 — 95	91 — 96	93½	..	+1	5 4 2
528,935	Do. do. 4½ % 2nd Deb. Stock Red.	100	4½%	4½%	4½%	4½%	71 — 75	73 — 77	74½	73½	+2	5 16 11
100,000	British Insulated and Helsby Cables	5	8 %	8 %	10 %	..	5⅜ — 6⅛	5⅜ — 6⅛	..	..	..	8 0 0
100,000	Do. do. 6 % Cum. Pref.	5	6 %	6 %	6 %	6 %	5⅜ — 6¼	5⅜ — 6¼	..	..	..	4 16 0
500,000	Do. do. 4½ % 1st Mort. Deb. Red.	100	4½%	4½%	4½%	4½%	102 —105	102 —105	105	..	..	4 5 9
212,000	British Thomson-Houston 4½ % 1st Mort. Debs.	100	4½%	4½%	4½%	4½%	93 — 98	93 — 98	..	..	..	4 11 10
400,000	British Westinghouse 6 % Pref., 1 to 200,000 and 275,001 to 475,000	5	Nil	Nil	Nil	Nil	7/16 — 11/16	7/16 — 11/16	11/3	8/9	..	Nil
1,016,358	Do. do. 4 % Mort. Deb. Stock	100	4 %	4 %	4 %	4 %	45 — 50	45 — 50	..	..	..	8 0 0
50,000	‡ Browett, Lindley & Co., Ord.	1	Nil	Nil	Nil	Nil	⅜ — ½	⅜ — ½	..	..	..	Nil
50,000	‡ Do. do. 6 % Cum. Pref.	1	Nil	Nil	Nil	Nil	14/6 to 15/6	14/6 to 15/6	..	..	..	Nil
105,731	Brush Electrical Engineering, Ord., 1 to 105,731	2	Nil	2½%	Nil	Nil	0— ¼	0 — ¼	..	..	..	Nil
150,000	Do. do. Non-cum. 6 % Pref.	2	6 %	6 %	Nil	Nil	3/16 — 5/16	3/16 — 5/16	..	..	..	Nil
125,000‡	Do. do. 4½ % Perp. Deb. Stock	Stock	4½%	4½%	4½%	4½%	70 — 75	70 — 75	..	..	..	6 0 0
125,000‡	Do. do. 4½ % Perp. 2nd Deb. Stock	Stock	4½%	4½%	4½%	4½%	55 — 60	55 — 60	..	..	..	7 10 0
100,000	Buenos Ayres & Belgrano, 1 to 100,000	5	4 %	3 %	3 %	..	4⅜ — 4¾	4⅜ — 4¾	96/3	..	..	3 1 6
40,000	Do. do. "A" 6 % Cum. Pref., 1 to 40,000	5	6 %	6 %	6 %	6 %	4⅜ — 5⅛	4⅜ — 5⅛	..	..	..	5 17 1
27,500	Do. do. "B" do., 1 to 27,500	5	6 %	6 %	6 %	6 %	4⅜ — 5⅛	4⅜ — 5⅛	..	..	..	5 17 1
136,400	Do. do. 5 % Deb. Stock	100	5 %	5 %	5 %	5 %	110 —116	110 —116	..	..	..	4 6 2
190,000	Do. do. 5 % 2nd Deb. Stock	100	5 %	5 %	5 %	5 %	102 —105	102 —105	..	..	..	4 15 3
187,610	Calcutta Trams, 1 to 187,610	5	8 %	8 %	8 %	6 %	5⅝ — 6⅜	5⅝ — 6⅜	..	..	..	4 14 1
30,000	Do. 5 % Cum. Pref., Nos. 1 to 30,000	5	..	5 %	5 %	5 %	5 — 5⅜	5 — 5⅜	..	..	..	4 13 0
950,000	Do. 4½ % 1st Deb. Stock	100	4½%	4½%	4½%	4½%	103 —106	103 —106	104½	104½	..	4 4 11
85,000	Callender's Cable Construction shares	5	12½%	15 %	15 %	15 %	9⅜ — 10⅜	9⅜ — 10⅜	10	..	..	6 19 6
40,000	Do. do. 5 % Cum. Pref.	5	5 %	5 %	5 %	5 %	5⅛ — 5⅜	5⅛ — 5⅜	..	..	..	4 5 11
300,000	Do. do. 4½ % 1st Mort. Deb. Stock Red.	Stock	4½%	4½%	4½%	4½%	107 —109	107 —109	..	..	..	4 2 7
491,222	Cape E Trams., 1 to 491,222	1	5 %	Nil	Nil	Nil	1/16 — 3/16	1/16 — 3/16	..	..	..	Nil
450,000	Castner-Kellner Alkali, 1 to 450,000	1	4 %	6 %	8 %	..	1¼ — 1⅜	1¼ — 1⅜	..	..	..	5 11 4
215,045	Do. do. 4½ % 1st Mort. Deb. Stock	100	4½%	4½%	4½%	4½%	101 —104	101 —104	..	..	..	4 6 7
1,893,610	Central London Railway, Ord. Stock	Stock	4 %	4 %	4 %	3 %	81 — 84	81 — 84	83⅜	81½	..	3 11 5
553,195	Do. do. 4 % Pref. Stock	Stock	4 %	4 %	4 %	4 %	90 — 92	90 — 92	..	..	..	4 7 0
553,195	Do. do. Def. do.	Stock	4 %	4 %	4 %	2 %	64 — 67	64 — 67	65⅛	..	..	2 19 8
1,480,000	City and South London Railway	Stock	2½%	1½%	2½%	2½%	40 — 42	40 — 42	41	40½	..	5 1 2

* Unless otherwise stated, all shares are fully paid. † A period of nine months. ‡ From Manchester Share List.

Continued on next page

SHARE LIST OF ELECTRICAL COMPANIES.—(*Continued.*)

ELECTRICAL RAILWAY, MANUFACTURING AND INDUSTRIAL COMPANIES.—(*Continued*)

Present Issue.	NAME.	Stock or Share.	Dividends for the last four years.				Closing Quotations June 2nd.	Closing Quotations June 9th.	Business done week ended June 9th, 1908.		Rise + or Fall —	Present Yield per cent.
		*	1904.	1905.	1906.	1907.			Highest	Lowest.		£ s. d
85,000	Crompton & Co., Nos. 1 to 85,000	S	2½%	2½%	5 %	5 %	1⅛— 1¼	1⅛ — 1¼	..	..	..	8 13 11
100,000	Do. 5 % 1st Mort. Reg. Debs., 1 to 900 of £100, and 901 to 11,000 of £50 Red.	..	5 %	5 %	5 %	5 %	92 — 95	92 — 95	..	..	..	5 5 11
260,000	Dick, Kerr & Co., 1 to 260,000	1	10 %	10 %	10 %	10 %	1 15/16— 1 15/16	1 15/16— 1 15/16	..	..	..	7 12 5
305,000	Do. do. 6 % Cum. Pref., 1 to 305,000	1	6 %	6 %	6 %	6 %	1 — 1¼	1 — 1¼	..	..	..	4 16 0
282,580	Do. do. 4½ % Deb. Stock	100	4½%	4½%	4½%	4½%	101 —104	101—104	..	..	..	4 6 7
60,000	Dublin United Trams. (1896), 1 to 60,000	10	6 %	6%	6 %	6¾%	12½— 13½	12½— 13½	..	..	..	4 18 2
59,987	Do. 6 % Pref. between 1 and 60,000	10	6 %	6 %	6 %	6 %	12½— 13½	12½— 13½	..	..	..	4 7 8
99,261	Edison & Swan Utd., "A" shs., £3 pd., 1 to 99,261	5	2½%	4½%	4½%	4½%	3/16— 5/16	3/16— 5/16	..	..	..	16 15 0
17,189	Do. "A" shares, 01—017,189	5	2½%	4½%	4½%	4½%	1⅛— 2⅛	1⅛— 2⅛	..	..	..	8 6 9
319,475	Do. 4 % Deb. Stock Red.	100	4 %	4 %	4 %	4 %	78 — 81	78 — 81	..	..	..	4 18 9
72,220	Do. 5 % 2nd Deb. Stock Prov. Certs. all pd.	100	5 %	5 %	5 %	5 %	85 — 87	85 — 87	..	..	..	5 14 11
112,100	Electric Construction, 1 to 112,100	2	Nil	Nil	Nil	Nil	3/16— 5/16	3/16— 5/16	..	..	..	Nil
31,390	Do. do. 7 % Cum. Pref., 1 to 31,390	2	7 %	7 %	Nil	Nil	1⅛— 1½	1⅛— 1½	..	..	..	Nil
25,000	General Electric Co. (1900), 5 % Cum. Pref.	10	5 %	5 %	5 %	5 %	7½— 8½	7½— 8½	..	..	..	6 1 8
200,000	Do. do 4 % Mort Deb.	Stock	4 %	4 %	4 %	4 %	87 — 90	87 — 90	..	..	..	4 8 11
78,000	Gt. N. & City Rail. Pref. Ord. "A" 4 %, 1 to 78,000	10	4 %	4 %	4 %	3½%	2— 1½	2— 1½	..	..	..	3 6 8
96,000	Greenwood & Batley, 7 % Cum. Pref.	10	7 %	7 %	7 %	..	10½— 10⅝	10½— 10⅝	..	..	..	6 10 8
80,000	Do. do. 5 % Mort. Debs.	100	5 %	5 %	5 %	..	102 —106	102 —106	..	..	..	4 17 1
40,000	Henley's (W. T.), Telegraph Works, Ord.	5	15 %	15%	15 %	15%	10½— 11½	10½— 11½	..	..	..	8 18 10
40,000	Do. do. 4½ % Pref.	5	4½%	4½%	4½%	4½%	5 — 5⅝	5 — 5⅝	..	..	..	4 1 10
150,000	Do. do. 4½ % Mort. Deb. Stock	Stock	4½%	4½%	4½%	4½%	104 —106 xd	104 —106 xd	..	..	..	4 4 11
50,000	India-Rubber, Gutta-percha & Telegraph Works.	10	5 %	10%	10 %	..	15½— 16½	15½— 16½	..	..	..	6 1 8
37,500	†Liverpool Overhead Railway, Ord.	10	1½%	Nil	Nil	½%	1⅛— 1⅜	1⅛— 1⅜	..	..	..	Nil
10,000	† Do. do. Pref., fully paid	10	5 %	5 %	5 %	5 %	5½— 6½	5½— 6½	..	..	..	8 0 0
600,070	London United Trams. (1901), 1 to 50,007	10	6 %	3 %	3 %	..	6½— 6⅝	6½— 6⅝	..	..	..	4 8 11
399,980	Do. do. 60,008 to 100,000	10	6 %	3 %	3 %	..	6½— 6⅝	6½— 6⅝	..	..	..	4 8 11
125,000	Do. do. 5 % Cum. Pref., 1 to 125,000	10	5 %	5 %	5 %	5 %	7 — 8	7 — 8	8	7⅛	..	6 5 0
1,331,000	Do. do. 4 % 1st Mort. Deb. Stock	100	4 %	4 %	4 %	4 %	80 — 85	81 — 86	82	..	+1	4 13 0
5,732,062	Metropolitan Consolidated	100	3 %	2⅜%	1 %	⅛%	43½— 44½	42 — 43	43½	42⅜	—1½	1 3 3
2,640,914	Do. Surplus Lands	100	2¾%	2⅜%	2¾%	2¾%	67 — 69	68 — 70	68½	..	+1	3 18 7
3,235,000	Do. District	100	Nil	Nil	Nil	Nil	14 — 15	14 — 15	14⅜	14⅛	..	Nil
314,016	Metropolitan Electric Trams., Defd.	1	Nil	Nil	Nil	..	3/32— 5/32	1/- — 5/32	1/-	..	..	Nil
500,000	Do. do. 5 % Cum. Pref.	1	5 %	5 %	5 %	5 %	1/4— 3/8	1/4— 3/8	15/3	15/-	..	6 3 1
350,000	Do. do. 4½ % Deb. Stock Red.	100	4½%	4½%	4½%	4½%	24 — 97	95 — 98	..	..	+1	4 11 10
245,500	Potteries E. Trc.	1	5 %	4 %	4 %	4 %	1/4— 3/8	1/4— 3/8	..	..	..	8 0 0
245,500	Do. 5 % Cum. Pref.	1	5 %	5 %	5 %	5 %	1/4— 3/8	1/4— 3/8	..	..	+1/16	6 13 4
245,000	Do. 4½ % Deb. Stock	100	4½%	4½%	4½%	4½%	91 — 94	91 — 94	93	..	..	4 18 9
37,350	Telegraph Construction and Maintenance	12	15 %	15 %	15 %	17½%	29 — 31	29½— 31½	30½	29	+ ½	6 13 4
150,000	Do. 4 % Deb. Bds., 1 to 1,500 Red., 1909	100	4 %	4 %	4 %	4 %	101 —103	101½—103⅜	101¾	..	+ ⅜	3 17 4
3,599,200	Undergd. E. R., Lon., 5 % Profit Shar. S. Nts.	..	5 %	5 %	5 %	5 %	39 — 43	39 — 43	..	..	..	11 12 6
66,666	Willans & Robinson, 1 to 30,000 & 30,001 to 116,666	1	Nil	Nil	Nil	10 %	3/32— 1/4	3/32— 1/4	..	..	..	0 0
66,666	Do. 6 % C.P., 30,001 to 30,000 & 125,001 to 141,666	5	Nil	Nil	..	6 %	8⅜— 8¾	8⅜— 8¾	..	..	..	7 10 0
46,404	Do. 4 % 1st Mort. Deb. Stock	100	4 %	4 %	4 %	4 %	70 — 74 xd	70 — 74	..	..	..	5 5 8

ELECTRICITY SUPPLY COMPANIES.

15,000	Bromley (Kent) E.L. & P., 1 to 15,000	5	5½%	5½%	5½%	5½%	4½ — 5	4½ — 5	..	..	..	5 10 0
70,000	Do. do. 4½ % 1st. deb. stock	100	4½%	4½%	4½%	4½%	94 — 97	94 — 97	..	..	..	4 10 11
20,131	Brompton & Kens. Elec. Lt. Sup., Ord., 1 to 20,000	5	10 %	10 %	10%	10 %	6½— 7⅛	6½— 7⅛	7⅛	..	..	6 13 4
9,869	Do do. 7 % Cum. Pref.	5	7 %	7 %	7 %	7 %	6⅝— 7⅜	6⅝— 7⅜	..	..	..	4 10 4
398,876	Central Electric Supply 4 % Guar. Deb. Stock	100	4 %	4 %	4 %	4 %	97 —100	98 — 101 xd	..	..	..	3 19 8
80,000	Charing Cross and Strand Electricity Supply	5	8 %	5 %	5 %	5 %	3½— 3⅝	3¾— 4	70/-	..	+ ¼	6 5 0
80,000	Do. do. do. 4½ % Cum. Pref.	5	4½%	4½%	4½%	4½%	4½— 4⅝	4½— 4⅝	..	..	..	4 17 4
80,000	Do. "City Undertaking" 4½ % Cum. Prf.	5	4½%	4½%	4½%	4½%	3⅝— 4¼	3⅝— 4¼	81/3	8/-	..	5 5 11
445,736	Do. do. 4 % Deb. Stock Red.	100	4 %	4 %	4 %	4 %	96 — 99	96 — 99	..	..	..	4 0 10
49,486	Chelsea Electricity Supply, Ord.	5	6 %	6 %	4½%	4½%	3 — 3½	3 — 3⅜	66/3	63/9	..	6 8 7
175,000	Do. do. 4½ % Deb. Stock Red.	Stock	4½%	4½%	4½%	4½%	101 —104	101 —104	..	..	..	4 6 7
70,595	City of London Elec. Lighting, Ord. 40,001—110,595	10	6 %	6 %	6 %	6 %	9 — 10	9½— 10¼	9⅝	..	..	6 0 0
40,000	Do. 6 % Cum. Pref., 1 to 40,000	10	6 %	6 %	6 %	6 %	12 — 13	12 — 13	..	..	..	4 12 4
400,000	Do. 5 % Db. Stk., Scrip. (iss. at 115) all pd.	5	5 %	5 %	5 %	5 %	124 —127	124 —127	..	..	..	3 18 9
800,000	Do. 4½ % 2nd. Db. Stk., Prov. Crts., all pd.	100	4½%	4½%	4½%	4½%	102 —105	102 —105	103½	..	..	4 5 9
40,000	County of Durham Electrical Power, Ord.	5	£3 7 0	4 %	4 %	2 %	2⅛— 3	2⅛— 3	..	..	..	3 6 8
50,000	Do. do. do. 5 % Pref.	5	5 %	5 %	5 %	5 %	3⅝— 4⅛	3⅝— 4⅛	..	..	..	5 17 8
40,000	County of London Electric Lighting, Ord. 1—40,000	10	4½%	5 %	5 %	5 %	7⅛— 8⅛	7⅛— 8⅛	7⅞	..	..	6 1 8
40,000	Do. do. 6 % Pref., 40,001—60,000	10	6 %	6 %	6 %	6 %	10⅝— 10⅞	10⅝— 10⅞	10¹⅞	10½	..	5 10 4
400,000	Do. do. 4½ % Deb. Stock	..	4½%	4½%	4½%	4½%	107 —110	107 —110	..	..	..	4 1 10
400,000	Do. do. 4½ % 2nd. Deb. Stock	Stock	4½%	4½%	4½%	4½%	97 —100	98 —101	..	..	+1	4 9 1
80,000	Edmundson's Electric Corporation, Ord. Shares	5	7 %	4 %	Nil	Nil	1/16— 1/8	0 — 1/4	2/6	..	— ⅛	Nil
80,000	Do. do. 6 % Cum. Pref.	5	6 %	6 %	3 %	Nil	¾ — 1	¾ — 1	12/6	..	..	12 0 1
433,000	Do. do. 4½ % 1st Mort. Deb. Stk.	100	4½%	4½%	4½%	4½%	65 — 75	63 — 73	69½	..	—2	6 8 3
10,000	Folkestone, 1 to 10,000	5	5½%	5½%	5½%	5½%	4⅝— 5¼	4⅝— 5¼	..	..	..	5 4 9
10,000	Do. 5 % Cum. Pref., 1 to 10,000	5	..	5 %	5 %	5 %	5 — 5⅜	5 — 5⅜	..	..	..	4 10 11
90,000	Do. 4½ % 1st Deb. Stock	100	4½%	4½%	4½%	4½%	94 — 97	94 — 97	..	..	..	4 12 9
15,000	Hove, 1 to 15,000	5	8½%	9 %	9 %	8½%	6 — 6⅛	6 — 6⅛	6⅛	..	..	6 10 9
21,000	Kensington and Knightsbridge Electric Ord.	5	12 %	10 %	10 %	10 %	7 — 8	7 — 8	..	..	..	6 5 0
90,000	Do. do. do. 4 % Deben. Stk.	Stock	4 %	4 %	4 %	4 %	96 — 99	96 — 99	..	..	..	4 0 10
10,000	London Electric Supply Corporation, Limited, Ord.	3	3 %	4 %	4 %	2½%	⅛— 1⅜	⅛— 1⅜	18/9	..	..	5 8 1
70,000	Do. do do 6 % Pref.	5	6 %	6 %	6 %	6 %	4⅛— 4¾	4⅛— 4¾	..	..	..	6 6 4
74,395	Do. do. 4 % 1st Mort. Deb. Stk. Red.	Stock	4 %	4 %	4¼%	4¼%	90 — 93	90 — 93	..	..	..	4 16 9
200,000	Metropolitan Electric Supply, 1 to 100,000	5	10 %	10 %	8 %	6¾%	4⅝— 4⅞	4⅝— 5	..	..	+⅛	6 10 0
76,121	Do. 4½ % Cum. Pref. 1—71,106	5	4½%	4½%	4½%	4½%	4⅝— 4⅞	4⅝— 5	..	..	+ ⅛	4 10 0
220,000	Do. 4½ % 1st Mort. Deben. Stock	..	4½%	4½%	4½%	4½%	107 —111	107 —111	..	..	..	4 1 1
250,000	Do. 3½ % Mort. Deben. Stock Redem.	Stock	3½%	3½%	3½%	3½%	85 — 90	85 — 90	..	..	..	3 17 9
250,000	Midland Electric Corporation, 4½ % 1st Mort. Deb.	100	4½%	4½%	4½%	4½%	96 — 99	96 — 99	..	..	..	4 5 10
87,500	Newcastle-on-Tyne, 1 to 87,500	5	8 %	8 %	8 %	8 %	5½— 6	5½— 6	..	..	..	6 13 4
87,500	Do. 5 % Pref., 1 to 87,500	5	5 %	5 %	5 %	5 %	5⅛— 5½	5⅛— 5½	..	..	..	4 10 11
10,852	Notting Hill Electric Lighting	10	7 %	7½%	7½%	7½%	11½— 12½	11½— 12½	..	..	..	5 12 0
20,000	Oxford, 1 to 96 and 407 to 20,310	5	7 %	7 %	7 %	7 %	6⅛— 6½	6⅛— 6½	..	..	..	5 12 0
50,000	Do. 4 % Deb. Stock	100	4 %	4 %	4 %	4 %	94 — 98	94 — 98	..	..	..	4 1 8
40,000	St. James' and Pall Mall Electric Light, Ord.	5	14½%	12½%	10 %	10 %	7½— 8½	7½— 8½	7⅝	..	..	6 3 1
20,000	Do. do. 7 % Pref. 20,001 to 40,000	5	7 %	7 %	7 %	7 %	6⅞— 7⅛	6⅞— 7⅛	..	..	..	4 16 7
150,000	Do. do. 3½ % Deb. Stock Red.	100	3½%	3½%	3½%	3½%	85 — 90	85 — 90	..	..	..	3 17 9
12,000	Smithfield Markets Electric Supply, Ord.	5	4 %	4 %	Nil	Nil	1/4— 3/8	1/4— 3/8	..	..	..	Nil
50,000	Do. do. do. 4 % Deb. Stock	Stock	4 %	4 %	4 %	4 %	70 — 74	70 — 74	..	..	..	5 8 1
65,000	South London Electricity Supply, Ord.	5	4 %	4 %	3 %	4 %	2¼— 2⅜	2¼— 2⅜	..	..	..	7 5 5
120,000	South Met. Elec. Lt. & Power, Ord.	1	Nil	2½%	2½%	2½%	⅜— ⅝	⅜— ⅝	..	..	..	3 6 8
117,968	Do. do. 7 % Pref.	1	7 %	7 %	7 %	7 %	1 1/16— 1 1/16	1 1/16— 1 1/16	..	..	..	5 6 8
200,000	Do. do. 4½ % 1st Deb. Stk.	100	4½%	4½%	4½%	4½%	99 —102	99 —102	..	..	..	4 8 3
80,000	Urban Electric Supply, Ord.	5	5 %	5 %	5 %	5 %	1 — 2	1 — 2	..	..	..	12 10 0
50,000	Do. do. 5 % Cum. Pref.	5	5 %	5 %	5 %	5 %	1⅝— 2⅛	1⅝— 2⅛	..	..	+ ⅛	11 2 2
200,000	Do. do. 4½ % 1st Mort. Db. Stk. Red.	100	4½%	4½%	4½%	4½%	87 — 90	87 — 90	..	..	..	5 0 0
110,000	Westminster Electric Supply, Ord.	5	14 %	13 %	12 %	10 %	7½— 8	7½— 8	7⅞	7 7/16	..	6 5 0
81,979	Do. do. 4½ % Cum. Pref. (Original 5 %—Red. to 4½ % from 31st Dec., 1905)	5	5 %	5 %	4½%	4½%	4⅛— 5⅛	4⅛— 5⅛	..	..	+ ⅛	4 9 9

* Unless otherwise stated, all shares are fully paid. † Quotations on Liverpool Stock Exchange. § Interim Dividend.

Bank rate of Discount 2½ per cent., May 28th, 1908.

REVIEWS.

Experimental Electrical Engineering and Manual for Electrical Testing. By V. Karapetoff. New York: John Wiley and Sons. Price 25s. 6d. net.

This most unwieldly treatise of about 800 pages, and 34 chapters, hails from Cornell. It is intended to cover the requirements both theoretical and practical of students during the junior and senior years of their course. As a manual for testing it contains over 200 experiments.

The preliminary "General Remarks on Electrical Laboratory Work" contain some amusing reading. "The right attitude of mind is the most essential condition for success in any kind of work," and "I am coming to the laboratory to get as much information and practical experience as possible, *this is to my own interest.*" This smacks of the Almighty Dollar! Further on we read: "An accident is possible only as a result of gross negligence," and a few paragraphs further "should anything go wrong, an instrument be damaged, a rheostat burned out, &c., do not try to hide the fact, but report without delay to the instructor!!" "In performing an experiment, start with the most difficult conditions, heaviest load, lowest power factor, highest voltage, &c.!!"

On page 1 Ohm's law is dealt with, and practical methods of measuring resistance follow, although current and E.M.F. do not appear to be defined. There is merely a statement that R is the "coefficient of proportionality" between these quantities. On page 7 the student has reached "Determination of Temperature Rise by increase of Resistance in a Coil." In this test the difference between the results obtained by thermometers and search coils is pointed out.

On page 12 a substitution method for finding the resistance of an electrolyte is given, which does not work in practice. Descriptions of various testing instruments follow, treated in a non-mathematical manner.

The next chapter, Ammeters and Voltmeters, construction and operation, contains the usual elementary diagrams of the different types without any troublesome mathematical explanations, and the following chapter has pictures of the outside and general appearance of the Weston instrument and its "precision" scale, Leeds and Northrup potentiometer, and ditto for the Kelvin balance, and a standard resistance.

Wattmeters follow, and here again much valuable space is wasted with catalogue figures of no earthly use to a student, who does not care about the appearance of the "General Electric polyphase integrating wattmeter." The Wright maximum demand indicator fittingly closes a most uninteresting chapter.

Then follow chapters on Reactance and Resistance, Electrostatic Capacity, Magnetic Circuit, Permeability Tests, Measurement of Core Loss, Photometry of Arc and Incandescent Lamps, Interior Illumination, Transmission Lines, Distributing Lines, Direct-Current Generators, Direct-Current Motors and twenty other chapters dealing with everything electrical, such as:—Elements of Telephony, Electric Welding, Railway Work, Switchboards, Electric Batteries, Induction Motors, Rotary Converters, &c.

The chapter on Permeability Tests describes almost every known form of permeammeter, omitting the troublesome mathematics of course as much as possible. This will render the double-yoke method of Ewing, which is described, not very easy to understand.

Similarly with the measurements of hysteresis losses, the details are merely descriptive, although the theory of the Ewing hysteresis tester is simple enough, and might have been given.

A good deal of space is taken up with photometry and the measurement of "mean spherical intensity." Is it not a fact that in practice "mean spherical intensity" is of little or no use to us? All we care about is that sufficient illumination is obtained on the book page, or table top, &c. To say a lamp has a "mean spherical intensity" of so much, is about as interesting to the average practical electrician as the contents of a sarcophagus. However, "mean spherical intensity" and "Rousseau diagrams" give students something to do in the laboratory, and possibly that justifies their existence.

The chapter on Interior Illumination consists chiefly of a collection of a few catalogue pictures of lamp shades, and the usual remarks regarding the great increase of light by using "holophane" globes, &c. Nothing is said about the effect of wallpapers in increasing the total light in a room, which, to the writer, seems a much more important matter than the use of globes.

The remainder of the book is of the same scrappy nature, and the reader can understand the "confusion worse confounded" when every here and there experiments occur for the student to repeat. Fig. 496 of an Otis elevator shows the usual price-list picture, and gives one the impression that the lift was floating in the "Ethereal Blue." What can be the use of such things as picture No. 498, controller and regulator, and fig. 58, "The Westinghouse Graphic Recording Voltmeter"?

The "experiments" go on like the everlasting brook throughout the whole ponderous volume. Some of these in the chapter on Switchboards are as follows:—

Assembling direct-current switchboard
Do. alternating do. !!

The author states that it is difficult to test a three-phase motor on the brake, p. 561. The necessity for using two wattmeters and changing over one wattmeter connection is urged as an objection, and he suggests making the motor drive some load, measuring the input and then deducting the losses from the input. This does not eliminate changing over the wattmeter connection, and does not give the true mechanical efficiency. The writer has never found any trouble with a properly lubricated brake in determining the efficiency, and the two wattmeters are no trouble whatever, and rather interesting to students.

The feeling one has on lifting this book is that it is too heavy to read with comfort in a railway carriage. Having read through it, you conclude that it is a glorious epitome of scrappiness. Its scope, however, in the words of Dominie Sampson, is simply "prodigious." Twenty years ago such a book might have served a useful purpose; the day of the cyclopædia is now, however, long past.

Producer Gas.—An interesting paper on "Producer Gas" appears in the *Street Railway Journal* from the pen of Mr. W. B. Tuttle. He pays particular attention to the question of hydrogen in producer gas. He does not like hydrogen, and fully supports the views first set forth by the late B. H. Thwaite as to the undesirableness of much hydrogen. Hydrogen burns very quickly, much more so than does carbon monoxide. Now, if the ignition is made early enough to get rid of the monoxide, the hydrogen will explode too soon; if the ignition is late enough to suit the hydrogen, then the monoxide will pass away partially unburned. Thwaite liked a small percentage of hydrogen, for he allowed that it did help to spread combustion throughout the mass of the charge. Too much hydrogen is easily introduced if steam is used to cool the bars or fuel-bed. But Mr. Tuttle advises that the cooling effect may be secured by turning back some of the exhaust gases made in the engine. As this gas is partly CO_2 and largely nitrogen, its effect will be damping on the temperature, for the CO_2 will absorb carbon, and efficiency will also be promoted, while clinker will be prevented. Analyses of producer gas, with and without return of gas to the base, are given, and are as follows:—

	Using exhaust gas.	Ordinary system.
CO_2	1·8	5·8
Oxygen	1·2	1·3
CO	26·2	19·8
Hydrogen	0·4	15·1
CH_4	0·7	1·3
Nitrogen	69·7	56·7
B.TH.U. per foot	103·7	136·0

The hydrogen is reduced to a very low figure, and the gas is reduced to nearly 100-B.TH.U. capacity. The poorer gas gave a better result when tested in an engine, and the fuel per B.H.P.-hour was reduced from 1·8 lb. to only 1·12 lb.; the average B.H.P. being, however, 102·5, as against 84·1. A disadvantage of hydrogen is that, while nominally of the same value calorifically per cb. ft. as is carbonic oxide, it is really of much less value, because so much of its calorific capacity disappears, at ordinary engine exhaust temperatures, in the form of latent heat. Altogether, this is quite an interesting article, and shows that sound ideas are spreading.

PROBLEMS IN TIME SWITCHING.

By IGNOTUS.

With the advent of discriminating methods of charging for electricity supply for special purposes, there has arisen a demand for automatic means for ensuring that a particular class of current consumption device shall not be used during hours which are excluded by the conditions of special contracts. Such a cases arises, for example, in the use of current off the peak, and one of the bases of the contract is the determination of fixed hours per day during which the current may not be used, or if it is used, must be measured separately and charged for at a higher rate; time-switch devices have, therefore, been developed, and have passed through a series of steps in their evolution towards perfection. The time-switch is now quite within the range of practical politics and, as nowadays made by respectable firms, is a thoroughly reliable article. As a result of long-continued experience in this class of work, the following requirements seem to be essential for the proper performance of the important function of time switching.

The simplest time switch is that which provides for one day, and has to be rewound and reset in that time. The clock for such a device is quite an ordinary affair, but should be one of the best of its class that is commercially possible. The next step is that of a clock which can be run for a longer period, such as 14 or 45 days, and which must, of course, be a clock of exceptionally good construction, free from liability to magnetisation, compensated for temperature variations, and preferably possessing a balance movement, as it is found that the use of a pendulum clock is hardly advisable where switches have to be installed in conjunction with it, and the slightest inaccuracy in level may cause the clock to stop. The whole of the clockwork should be entirely insulated from the switch, and should be thoroughly well fitted so as to be dustproof. To ensure correct running for long periods a fusee drive is the best that can be employed, as the drive should be of exactly the same strength on, say, the forty-fifth day, when the spring is nearly run down, as it was when the clock was newly wound.

The switchgear should have a positive action, *i.e.*, nothing but the stopping of the clock should prevent the switch from working. There should be no "hit or miss" about its action. Simplicity of construction is, of course, essential, not only with a view to keeping down the initial cost of the equipment, but also because of cost of maintenance and repair. "Tricky" devices, to get over troubles which should never have existed, should be studiously kept out. Rapid making and breaking of the circuits is very essential; on examination of a number of types of time switches now on the market, it will be found that although some types secure a rapid making of the circuit, while others specialise on breaking the circuit rapidly, it is not usual to find a switchgear which will perform both operations with rapidity.

Another thing which very largely determines the value of such a time-switch arrangement is the facility for varying the range of operations of the clock. Some time switches will only give a range of eight hours, while the hands of the perfect switch should be capable of setting within 10 minutes of each other. The Venner time switches, for example, which are types of the most advanced work in this department, are capable of giving a total range of nearly 23 hours. Another feature which should be possessed by time switches operating for long periods between windings, should be a selective device so arranged that the switches may *not* open or close their circuits on any desired day or number of days. The value of this arrangement will be seen when the question of advertising signs is considered.

The usual class of electric light signs is capable of being operated from, say, seven o'clock in the evening till a quarter past ten or eleven, and should then be switched off automatically. But it is contrary to the prejudices of a large proportion of the British public that such signs should be exhibited on Sunday, and for this reason the time-switching arrangement controlling the sign should be such as automatically to prevent the circuit being closed at the usual hour on Sundays. The contacts of the switch are the most important feature in the design of this type of switching arrangement. In the early days mercury contacts were much used, but it was found that for large currents the mercury was apt to get "muddy" or oxidised, and trouble, due to the splashing or blowing-out of the mercury, was experienced. Mercury contacts are still used even on 250 volts, but one firm using this type has a special form of mercury cup which consists of a short cylinder having at the top an inverted cone through which the copper plunger enters. The plunger makes direct contact on the head of a copper screw, and only a small amount of mercury is used to seal this contact. The inverted cone prevents any mercury from flying, and it will shortly be possible to obtain the mercury contact form of time switch up to 100 amperes capacity. For currents not exceeding 1½ amperes, an ordinary pressure contact is quite sufficient, provided that copper and German silver are carefully avoided. A platinum contact is essential for this class of work. With reference to the alarum-clock types of switch which are so common in the market, a point to be noted is that the spring should not tend to pull the switch out for the whole period of time during which the clock is in operation, but should only come into action when the clock alarum "goes off."

A very interesting form of switching arrangement, which can be used for 400 to 600-volt circuits of from 30 amperes capacity, consists of a main switch and a relay switch separately mounted. The main switch has a rotary form of electro-magnet, instead of the more ordinary type, the former being much more suitable for the purpose in view. A brush switch is used as giving a much more certain contact in an automatic system than the knife pattern. The relay gives a positive contact of definite duration, and easily deals with highly inductive circuits operating at an average voltage of 550 to a capacity of 5 amperes. This is a much more difficult problem than that solved by the usual "flick" switch, which makes an uncertain contact for a period of time which is never twice the same, and only deals with an infinitesimal current.

The time switch is likely to be an exceedingly useful feature in the problem of street lighting, where the supply is obtained from an ordinary distribution network. As will be readily conceived, a very important item of cost of the usual street lighting system is the laying of special cables from the town station in order to avoid interference with the ordinary private house lighting system. A very small time switch has been placed on the market which is suitable for being mounted on small street lamp-posts. It can be sold at so low a price that one can be put on each ordinary incandescent post. The advantage that this apparatus has over the human lamp-lighter is that it never requires a holiday, it never falls ill and it does not demand a periodic rise in wages. It does not oversleep itself nor stay too long over tea. It does not switch on the first part of a round half an hour too soon nor switch off the last part half an hour too late, so as to finish lighting and begin extinguishing at the proper times. By means of such a switch the central-station engineer could insert the thin end of the wedge by getting permission to convert a few lamps in different parts of the town, and could then carry on this work by connecting such posts across the private lighting mains. A further improvement in street lighting is the provision of a switch which will automatically switch in two circuits of lamps at dusk and put out No. 1 circuit at midnight, No. 2 circuit at daybreak; next day No. 2 circuit goes out first and No. 1 circuit last, thus equalising the burning hours. Alternatively, this switch can be arranged always to repeat the operations of the first day. Still another type of switch made is one which keeps on till 10 o'clock every night except Saturday, when it does not go out until two hours later. The number of days and the time can of course be changed for any required arrangement.

The importance of shop-window lighting after closing time is, except in one or two areas of supply, very little realised by electricity supply authorities. The use of the time switch for this purpose, however, opens up a lucrative source of revenue for just that portion of the evening when load is most desirable—say from 7.0 to 10.0. The possibility is presented to the central-station engineer by the application of electric time switching, of having an automatic

means of discriminating between the hours at which certain portions of his load can go on to his service system, and constitutes an economical working basis for a system of differential tariffs which could go a long way towards establishing the lighting of the station on a paying rate by a scientific application of the principles embodied in the component parts of the diversity factor of the central station. Moreover, this system forms a ready means of getting private consumers to employ small heating devices and radiators, and to these may be added in the case of shopkeepers, the keeping alight of their windows after closing time. If a consumer has to wire separate circuits in order to obtain the benefits of low rates for either of these purposes, the expense is sufficient in many cases to deter him from adopting such devices. A sub-meter system, while having advantages in certain cases, has the disadvantage that in the case of private houses, for example, the use of such heating apparatus is confined to one or two rooms. The subject has, up to now, been only partially and experimentally studied in England, but there are already indications that it is along this line that the solution of many of the financial problems underlying electricity supply will be found.

THE CONTINENTAL ELECTRICAL ENGINEERING INDUSTRY.

The Condition of the Cable Manufacturing Trade.

An upward movement in the shares of various electrical companies has recently taken place on the Berlin Stock Exchange. The rise has certainly not been prompted by the condition of the manufacturing trade, which has embarked upon a slower course, and it is therefore only capable of explanation by reason of the belief that the question of adopting electric traction on certain of the Prussian State railways, as well as on lines in Bavaria, has been advanced one stage nearer to realisation.

The Allgemeine Co., which this year celebrates the 25th year of its existence, proposes to make a fresh issue of bonds in the form of 4½ per cent. obligations amounting to £750,000. There is no immediate need for the provision of fresh capital, and the time for the emission has been left to the discretion of the directors.

The North-German Automobile and Motor Co., of Bremen, and capitalists at Munich, have just formed the Munich Electromobile Operation Co., to introduce electric cabs and other vehicles in the latter city. Similar undertakings are already at work in Hamburg and Dusseldorf that were also founded by the Bremen company in question.

German Works.

The recent general meeting of the shareholders in the Suddeutsche Kabelwerke (South German Cable Works Co.), of Mannheim, approved the accounts submitted for 1907, and the distribution of a dividend at the rate of 8 per cent., as in the preceding year. It was stated in the course of the directors' report that the financial results were unfavourably affected by the extraordinary collapse in the prices of raw materials, as this was accompanied by a rapid decline in the sale prices of manufactures, so that the latter in part no longer corresponded with the cost of production. In addition to this the cost of labour experienced an increase. The volume of business was about the same as in the preceding year. The accounts show the following figures for the past two years:—

	1907.	1906.
Share capital	£150,000	£150,000
Gross profits... ...	37,379	44,926
Working expenses	11,311	11,038
Depreciation provision ...	5,250	3,758
Net profits	21,481	29,572
Dividend, per cent. ...	8	8

The amount devoted to extra depreciation reached £7,500 in 1906, but the sum has been reduced to £5,000 in the past year, whilst nothing is allocated to the disposition fund, as compared with £5,000 in 1906. During the year the extensions of the works were completed, and it was possible to remove the working from Freudenstadt to the Mannheim industrial harbour, so that the whole of the manufacturing is now centralised there. It was stated at the recent meeting that a further fall in prices and retrogression in trade were no longer to be reckoned with, and that the degree of employment in the first three months of the current year was quantitatively better than in the same period of 1907, although the value of the orders was about on the same level.

The Deutsche Kabelwerke Gesellschaft, of Berlin-Rummelsburg, realised gross profits of £52,437 from manufacturing in 1907 and £2,436 from investments, these comparing with £63,188 and £962 respectively in the previous year. After meeting working expenses and providing £3,590 for depreciation, as against £3,307 in 1906, the accounts indicate a surplus of £15,335, as contrasted with £23,744 in the preceding 12 months. It is proposed to pay a dividend of 6 per cent. on the share capital of £175,000, as compared with 7 per cent. in 1906, when shares amounting to £62,500 only participated to the extent of one-half of the dividend. The directors attribute the decline in the revenue to increasing competition, higher wages, and the low level which the prices of raw materials have reached. It is mentioned that the Union Cable Co., Ltd., of London, in which the company is interested, has experienced a considerable extension of its business, and has consequently been induced to erect a factory in England, which will shortly be brought into operation.

The shareholders in the Kabelwerk Duisburg (Duisburg Cable Works Co.) approved the accounts submitted at the recent meeting, together with the payment of a dividend of 10 per cent. for 1907, on a capital of £75,000, being the same rate as in the preceding year. According to the directors' report, the degree of employment was very satisfactory; orders in excess of those booked in 1906 were received from State and local authorities, and important contracts were also concluded with industrial works. If notwithstanding this state of affairs the profits declined, the explanation was to be found in the reduction in the sale prices and the material advance in wages. After writing off £15,019 for depreciation as compared with £16,490 in 1906, the accounts showed net profits of £10,397 as against £15,768 in the previous year. The sum of £5,000 was allocated to the special reserve fund in 1906, but nothing has been appropriated for this purpose for the past year.

The Sachsenwerk, Licht und Kraft Gesellschaft (Saxon Works, Light and Power Co.) of Dresden-Niedersedlitz, which will perhaps be remembered as having arisen from the unfortunate Kummer undertaking of a few years ago, has not yet reached a stage of prosperity. During 1907 the turnover amounted to £215,000, as compared with £180,000 in the preceding year, and the surplus of income over expenditure in each year has enabled the deficit to be reduced from £21,447 to £7,950. At the same time the indebtedness to the bank has advanced from £14,000 to £39,800 on an ordinary share capital of £138,740. In order to extinguish this floating debt and to wipe out the remainder of the deficit, an extraordinary meeting of the shareholders has approved a scheme for the raising of 6 per cent. preference shares to the amount of the ordinary share capital. The ordinary shares are to be exchanged to the extent of 60 per cent. of their nominal value for the preference shares, leaving 40 per cent. to be paid up in cash.

Various Financial Results.

	1907.	1906.
Hartmann & Braun	12 %	12 %
Voigt & Haeffner	10 %	10 %
Bergmann Electricity Works	18 %	18 %
Max Schorch & Co.	7 %	8 %
Fabrik Isolierter Drahte	6 %	8 %
Vereinigte Isolatoren Werke	Nil	12 %
Elektrochemische Werke	9 %	9 %
Busch Car and Machine Works, preference shares	8 %	6 %
Busch Car and Machine Works, ordinary shares	3 %	1 %
International Electricity Co.	8 %	Nil

Swiss and Austrian Works.

The Alioth Electricity Co., of Basle, according to the directors' report for 1907, delivered dynamos and motors representing a total of 133,389 H.P., as compared with 95,396 H.P. in 1906, and transformers of 76,594 KW., and 50,670 KW. in the same periods respectively. During the whole of the year the shops were briskly employed on electric traction work, and large orders will be completed in 1908 and 1909. An electric locomotive of 2,000 H.P being built for a foreign company will be finished and set in operation about the end of the present year. An extensive high pressure and distributing network has been carried out for a large power company in France, and the orders brought over into the new financial year exceed those of the deliveries already mentioned for 1907. The profits amounted to £35,120, as contrasted with £32,160 in 1906, and after making provision for depreciation, the balance has allowed of the payment of a dividend of 6 per cent. on the £120,000 of preference shares, and 4 per cent. on the ordinary shares, these comparing with 5 per cent. and nil respectively in the preceding year.

The directors of the Aluminium Industry Co., of Neuhausen, which has declared a dividend of 20 per cent. for 1907, as compared with 26 per cent. in the preceding year, state in the course of their report that all aluminium producers endeavoured to enlarge their installations during the year or to establish new works. As a consequence the effects of the increased output made themselves perceptible in the second half of the year, and new competitive companies also began to supply the metal. In addition to this the American crisis caused an unfavourable reaction in the metal market, and this state of affairs still continued. The company had further advanced the completion of the new Wallais works near Chippis, the Navizance establishment was approaching a finish, and the large dam and canal works on the Rhone, together with the construction of the tunnel, were in full progress. The new plant at Goldschmieden for the working of alumina and by-products was already in operation, whilst the factory for the same purpose at Marseilles was on the point of being opened. The financial results for the past two years are as follows:—

	1907.	1906.
Ordinary paid capital...	£520,000	£520,000
Obligations	223,600	226,400
Gross profits	299,480	313,600
Depreciation provision ...	90,240	103,760
Net profits	214,480	215,120
Reserve fund appropriation ...	16,000	18,000
Dividend	104,000	135,200
Dividend, per cent.	20	26
Balance forward	54,240	5,240

It will be seen that by making a smaller provision for depreciation the net profits in 1907 were nearly the same as in the preceding year. On the other hand, the balance carried forward to the new year shows a considerable augmentation, and the directors state that the increase has been dictated by the necessity for the exercise of caution, owing to the obscure conditions of the aluminium market and the desire to be prepared for any incidental financial contingencies.

The orders received by the Felten & Guilleaume Co., of Buda-Pesth, in 1907, are stated in the directors' report to have been exceptionally brisk, all departments participating in the activity and being fully employed throughout the year, notwithstanding the completion of the extensions of the works. After making provision for depreciation, the net profits amounted to 460,665 kr., as compared with 266,512 kr. in 1906, and a dividend at the rate of 15 per cent. has been declared on a share capital of 1,500,000 kr., as against 12 per cent. in the preceding year.

The Felten & Guilleaume Co., of Vienna, realised net profits amounting to 2,259,700 kr. in 1907, as against 2,253,080 kr. in the previous year, and a dividend at the rate of 17½ per cent. has been declared, as compared with 15 per cent. in 1906. According to the directors' report, both the electrical and the Styrian iron works were actively employed, and the volume of business considerably increased. During the first two months of the new year, the turnover was larger than in the corresponding period of 1907, and no diminution in the arrival of orders had taken place.

Among other Austro-Hungarian firms may be mentioned the Ganz Electricity Co., which has declared a dividend of 5 per cent. for 1907, being the same rate as in 1906; the Electricity Co. (late Kolben), of Prague, 5½ per cent., as compared with 5 per cent. in 1906; and the Cable Works and Wire Industry Co., of Vienna, a dividend of 11 per cent. for 1907.

PROCEEDINGS OF INSTITUTIONS.

The Management of Engineering Workshops.

By Eustace Thomas, B.Sc.

(*Abstract of paper read before the* Institution of Electrical Engineers, *Manchester, April 14th*, 1908.)

Visits were paid to works engaged in widely different manufactures, and the details of organisation and of the "paper" used were gone into at great length. Most of the shops visited, which had an efficient modern organisation, were specialised shops where the work was almost wholly standard, and non-standard work was discouraged. The organisation of a general shop, where changes are frequent and much material is built to special order, is immensely more difficult, and the efficiency is frequently much less. Much of what follows relates to the general shop.

It is generally agreed that the workman should have only manual work, and all head work should be done by the draughtsman or designer. A complete list of material should be prepared in the office, containing every detail that may be required. In every case where the list is not prepared beforehand or is incomplete, the workman becomes a head worker, and he is usually a very inefficient and expensive one. There should be provided also a list of operations in every case where a new workman might possibly be in doubt; otherwise the foreman must give these instructions every time the work is given out. Even if the same man gets the job, his memory is not to be trusted. A list of tools, jigs, &c., saves head work and great waste of time, and they should be deposited ready on the man's bench or machine before he requires them.

The duties of foremen may come under two heads:—

A. *Clerical or Administrative.*—Such as giving out work, seeing that there is no delay caused by waiting for material; watching the efficiency of the workmen; planning to get work executed to time, &c.

B. *Technical.*—Methods, tools, and jigs, for executing work, for overcoming difficulties, for reducing cost of production, &c.

The most modern tendency seems to be to give the foreman function (A) to carry out. In regard to (B) he must be technical enough to know if matters are not going rightly, and in such case set an expert tool fitter to study them out and do what is required.

This seems to the author essentially the right system, *especially when day work is going on.*

All employés are liable to neglect or to alter certain of their duties, unless these are defined and a check frequently taken.

The best way to minimise these difficulties is to have a sufficient amount of red tape or routine, and to have a routine book for each man who has routine duties, ruled off for days or weeks. Each day or each week a tick or a date is put in the appropriate column to signify that that duty has been attended to, or to show the date to which that duty has been brought up. All these routine books go to the manager at a stated hour each week, and he can glance through a large number in a very short time. In the same way each week at a fixed hour the manager should walk round the works, and all books used should be laid out in readiness. The manager has his own routine, and should observe it as rigidly as he requires his subordinates to observe theirs.

In some of the works visited, all sorts of summaries and abstracts were prepared, which, if periodically inspected and acted on, would probably be more than worth their cost. But if not regularly examined they are worse than useless. It is of little use recording comparative costs if they are not looked at.

Material *must* be booked, and some one must write out a list of it. It is far the best way to do this in the office. The same list, if prepared with thought for standard work, can serve several important purposes, plenty of copies being prepared and distributed:—

A. The storekeeper marks it for material in stock or to order.

B. The stores issue goods from it to the foreman's auxiliary stores without further requisition.

C. The foreman can check by it all material at any stage.

D. The drawings having been cut up into as many parts as there are pieces or groups of pieces to be made, a copy of the list is also cut up and pieces attached to the divided-up drawings for the workmen's use.

E. On a further copy, against each item is marked the time by which it must be completed, in order that the whole of the work may go through to the date desired.

Each shop foreman must have his own copy marked.

F. A copy goes to the cost department. The work can be priced against this list in advance if required, and actual issues and returns can be checked against it.

It is well worth while to devise a system of catalogue numbers to cover all single pieces. A separate card is made out for each piece, and reference is entered to every drawing or job on which it is used.

The uses are numerous:—

A. This catalogue number appears on each drawing and on each list of material against each piece.

B. It facilitates comparison of costs.

C. It facilitates estimating by the ease of reference to all other pieces at all like it.

D. It facilitates standardisation by making it easy for any draughtsman to see what has been done before, and to use something already made if possible.

E. Patterns are marked with this number and stored in trays or spaces marked with the class number. This often saves new patterns by making reference easy to all existing ones.

F. The stores are arranged as far as possible to follow this classification.

It is probably well worth while to let the foreman have an auxiliary stores under his own control, with plenty of easily accessible shelves. All material for an order is delivered here and sorted out in a space prepared for it. With each lot is placed the drawing and even the job ticket. Special tools and jigs can also be collected with the material and all given out together.

Shop drawings consist of pieces of cardboard carrying that part of the drawing required for any one piece or group of pieces given out to one man only at a time. On the same card is the list of material cut off the general list, the list of operations, and the list of tools, gauges, jigs, &c. The separate cards are numbered serially and usually kept together.

The work should be checked at each stage for accuracy, and number of pieces; and any scraps should be dealt with and recorded and orders for replace parts at once attended to.

In one works a weekly return is made of—

A. Materials scrapped through fault in the material.
B. Labour wasted through fault in the material.
C. Labour wasted through faulty workmanship.
D. Material wasted through faulty workmanship.
E. Cost of putting any jobs right, if that is possible.

A slip cut off a duplicate of this return is pasted on to the cost card, and defects of workmanship are entered each week against the man on a special card giving his record for the half-year. This system has been working for some years, and it is considered that the saving which has resulted much more than pays the cost of the clerical work.

Inspection at each stage pays for itself, even in such work as switch work.

Stock jobs should not be too large, and work should be done on as few stock jobs as possible at one time, concentrating on these as many men as are available.

In cases where day work seems necessary, it should be insisted on that a price and time are estimated for each job, even though these are not made known to the men. The actual price and time must be compared later with this estimate.

The simplicity, comfort and general advantage of piece or premium work cannot be sufficiently proclaimed. With piece work a man seldom attempts to earn more than about time and a quarter, for fear of getting the rate cut. It was hoped, by the introduction of the premium system, that this difficulty would be got over, a promise being made that the time allowed should not be altered *unless a new method were adopted.* But the men know quite well that if they make too much premium *a new method will always be found.* The practical result is that the premium system requires just as much vigilance as the piece-work system. It has the disadvantage of requiring rather more book-keeping, and of rather more difficulty in adjusting the price when a mistake has been made.

Where it is considered that the best results are not being

obtained, the author is convinced that the only way to improve matters is to have enough expert men who are paid well, and can be relied upon to work in the employer's interest. Such men, for example, may act as rate fixers.

On small work especially, the proportion of non-cutting time is sometimes very great.

A cheap gauge or micrometer is badly required, which will tell in a second or two to ordinary men just how far they are off the final dimension; and then means are required to set the tool forward just that amount. The introduction of some cheap device of this sort will easily effect an appreciable percentage economy.

With belt-driven machines and cone pulleys, the speeds usually change in not less ratio than 1·75 to 1 or even 2 to 1. In the latter case we shall on the average be working at just three-quarters of the correct speed, and the cutting time is increased one-third. This is a very serious loss, and argues strongly the advantage of a gradual speed change device; also of some cheap speed indicator to be applied to the work and show instantaneously the rate of cutting. One large firm doing very accurate work provides a handle, which automatically shifts the belt by pressure to right or left. There is no doubt the cost of this has been repaid many times. Quick-change drill chucks, which enable the drill to be changed instantaneously without stopping the spindle, may easily save anything from 10 to 50 per cent.

In work requiring a number of operations to be performed from the same setting, and requiring a number of tools in successive use, the author was impressed with the small cutting time, and also with the loss in finding and picking up the exact tool required. A large block, having exactly as many holes as tools and gauges, and with these arranged in suitable groups, will save its cost many times over.

In America, and in a few cases in this country, visiting consultants are called in to examine the works and to suggest improvements. In any single concern there must be some tendency to stagnation, and there seems as good reason for the visiting consultant as for the visiting auditor, whose services are now regarded as essential, and taken as a matter of course.

In a general shop having many small jobs in hand at once it requires a very clever foreman to give times of completion of all work in hand which he can adhere to, and yet not have too much labour employed.

The author has devised a special indicator for the purpose, which gives the foreman a bird's-eye view of the work in hand, and of the capacity for work. It requires that time shall be estimated on all work in detail, whether on the day, piece or premium systems.

One or more suitable boards are laid out with horizontal grooves to represent the different men in classes according to employment, wages, &c.; some spare grooves are also allowed to each class. Vertical lines are drawn to scale to represent hours, days and weeks. Fairly narrow strips of card are cut off for each job, of length equal to the number of hours estimated, and marked with the job number and date by which completion is required.

These are then set up in the grooves, always to the left of the date marked on them. If there is more work in hand than capacity in men some cards must go into the spare grooves. The card to the left in each groove is always the job in progress at the time with that man, those to the right being arranged in the order of present urgency. They can be reshuffled later as altered circumstances may seem to require. Thus the foreman or manager can see at a glance what work is likely to be late, what is the present capacity for new work, stock work, &c., what jobs are hanging, and where it is desirable to take on or discharge men.

The material labourer can also see what materials, tools, &c., are likely to be required soon, and get them ready. The cost of keeping up is small, and amply repaid by the advantages.

Discussion.

Mr. Gunther said that much depended on the class of work to be done. It was possible to specialise on small work, but not in a general shop, a class which existed in large numbers. He agreed that details should be worked out and so leave no head work for the workman. His firm had made jigs for all standard parts, so that each part was interchangeable. He did not see the use of routine books in a general shop, as a man hardly ever had the same job to do twice. In a specialised shop they might be of use.

Mr. Bevis said a foreman should be engaged on work under class "A." He did not agree with the author as to weekly inspection at a certain time; he preferred to go when he thought fit. The main stores should keep all parts and issue to an assembly room the parts necessary for each job, no more and no less. He did not agree with making the working man a dummy; it would be a bad thing for the country when that was the case.

Mr. Eckstein thought the paper all through had reference to repetition work of a small nature. He always expected a man to use his common sense. Visiting consultants were excellent for a small works that could not afford to keep experts, but for a large works he thought the employment of consultants would do more mischief than good.

Mr. H. W. Wilson agreed that red tape was necessary, but it sometimes was carried to such an extent that it stopped a job. He knew such cases, and gave instances where jobs were stopped owing to a few screws being lost. The primary object of the works manager was to make money out of two things—viz., material and labour. Where he generally made it was in labour, and it was most desirable to have an expert time check.

Mr. Eustace Thomas, in reply, said there had been a misunderstanding as regards the inspection of the routine books. He meant that at a certain time each week the men should get out the books ready for the manager's inspection. It did not take many minutes to run through a large number, and if they were not inspected there was a danger of their being overlooked and possibly neglected.

Electric Elevators.

At a meeting of the Electrical Section of the Western Society of Engineers on January 10th, a paper prepared by Mr. J. D. Ihlder on "Electrical Elevators for High Buildings" was read, the subject matter of which is interesting in view of the progress it demonstrates in the electrical operation of elevators.

In this country the chief difficulties have long been overcome, and the advance in favour of the electric lift is unchecked. It is more than a formidable rival of the hydraulic lift. In these columns comparisons have been made of the safety and economy of electric and hydraulic elevators, and it is interesting to find figures coming from another sphere of activity powerfully supporting our own statements.

In America the conditions have enabled the hydraulic lift to hold sway—the sky-scraper having proved a harder nut to crack than our more moderate buildings. But the elevator for the high buildings of America is desirable prey for the electrical engineer, and, in view of modern improvements, a desirable load for the central station. Consequently, strenuous efforts have been directed to the perfecting of electrical machinery to meet the difficulties met with in the high buildings, with results which may be gathered from the following short *résumé* of Mr. Ihlder's paper, and extracts from the *Western Electrician's* report.

Up to the present time the development of the electric elevator for high buildings has been so slow as to give the hydraulic an almost entire monopoly of the field. Complex and unreliable controllers, high-speed motors, and high-speed drum rope driving have presented difficulties which have had to be overcome before the electric elevator could take its proper place in the front rank. Low-speed motors have enabled a return to be made to simplicity, and in conjunction with perfected controllers have brought the electric elevator to the front. Designers finding that the direct connection of the motor armature and driving sheave gave such excellent results, the gearless principle has recently been adopted. The method of application is as follows:—

"In this traction electric elevator, which is particularly adapted to high-speed service in high buildings, the motor is usually installed at the top of the hatchway, although in some cases it is placed in the basement. Four to six ⅝-in. ropes are generally used; they are run up from the car over the driving sheave, around an idler sheave, again over the driving sheave and the idler, and finally down to the counterweight. Each rope thus makes two half turns over the driver, which has been found amply sufficient to give the maximum traction effect required. The idler sheaves give a convenient way for directing the ropes so that the counterweights may be run in any desired portion of the hatchway, and at the same time afford a means of bringing the ropes to another portion of the driver for their second half turn about it. The motors used are either of a straight shunt or of a cumulative compound type, in which the series field is in action only at starting to give a better starting torque, and is effectively cut out as soon as running speed is attained. The motors are usually of about 35 H.P. and run at 60 R.P.M., with a maximum efficiency of 87 per cent., and an average efficiency of over 80 per cent. from 6 to 40 H.P. The method of control is simple and automatic. In stopping, the armature is short-circuited by a low resistance, and thus acts as an effective electric brake. The operator cannot lose control of his car. Safety switches at limiting points near the top and bottom of the hatchway cut off the power and apply an automatic brake. Other usual safeguards are provided, as well as special oil buffers at the limits of motion of the car and counterweight."

The author follows with a comparison of the efficiency of electric and hydraulic elevators. It is pointed out that, while the energy consumption of the hydraulic machine is almost constant, regardless of its live load, the electric consumes power proportional to its load, and does not vary in speed, as is the case with the hydraulic. The electric elevator, while requiring more starting power, gives a quicker service, owing to the fact that it makes a more rapid start and stop. Comparative tests under like operative conditions with machines of the best type showed an efficiency of 55 per cent. for the hydraulic elevator, as against 70 per cent. for the electric. As proof of the safety of the type of electric elevators under discussion, it was mentioned that they had been installed in two buildings in New York from 600 to 700 ft. high.

Engineers in this country are not so much interested in elevators for high buildings, but the running costs given below will be of interest.

Mr. Ihlder gave results obtained under average conditions which showed a consumption of 2·6 KW.-hours per car-mile. It is not usual here to describe lift consumption in car-miles, but the necessary calculations to convert to this reading are easily made. Some figures recently obtained of 120 ft. travel of a 5-cwt. load in cage at 110 ft. to 150 ft. per minute give 0·05 unit per journey, a result of 2·2 KW. per car-mile. The current consumptions of several electric passenger lifts of low speed and short travel, have been published in this journal, and they show a consumption per car-mile of about 2·5 KW. These lifts are purposely provided with a low-efficiency gear in order to do away with other safety devices. The direct drive, while undoubtedly reducing complications, is a method unsuitable for use in this country. Our buildings not being so

high, a much smaller speed is sufficient, and to obtain a direct drive it would be necessary to have motors of so low a speed that they would be most unwieldy.

Mr. Mabbs, the designer, describes another type of electric elevator. The principal feature is the employment of the driving motor as counterweight. To quote from the *Western Electrician*:—

"The motor travels up and down half the height of the building, propelling itself through worm and spur-gearing meshing into vertical racks. The cars are 6 ft. × 6 ft., an unusually large size, and the service load per car-mile is said to be the heaviest of any building in the country. The energy consumption averages 3·44 KW.-hours per car-mile. The machines work with entire satisfaction, accelerate and stop rapidly and smoothly, and operate efficiently, and with exceptionally small maintenance costs. The use of the worm-gear affords an absolute check on the car running away The gear runs smoothly in oil and gives no trouble whatever."

This method would certainly seem to be satisfactory, but it has the disadvantage of requiring a considerable amount of valuable space.

The discussion was concluded with the consideration of the value of a plan designed by Mr. Ellithorpe for safeguarding elevators. The inventor tightly closes in the base of the hatchway to form a large air cushion for any dropping car. To be effective, the cushion must extend to one-fifth the height of the shaft, and be most carefully designed. Unfortunately, an experiment carried out by the inventor had a fatal conclusion. While other safety devices are proving satisfactory, it is unlikely that so expensive a plan will be taken up by engineers.—P. G.

The Faraday Society.

SIR OLIVER LODGE ON "SOME ASPECTS OF THE WORK OF LORD KELVIN."

SIR OLIVER LODGE delivered his presidential address to the Faraday Society on May 26th, choosing as his subject an account of those sides of the work of Lord Kelvin—his predecessor—more or less on the borderland of chemistry and physics, those aspects, namely, which would have been specially likely to arouse the interest of Faraday, the godfather of the Society. Even with these limitations, however, so vast and all-embracing were Lord Kelvin's contributions to science, that whole regions of his work had to be entirely unmentioned.

On the most fundamental question in physics—the question of a universal connecting medium—it appeared to Sir Oliver Lodge that Lord Kelvin's position was something of a puzzle and an anomaly, for at the end of his life he was, so it seems, satisfied with the conception of unexplained forces acting at a distance according to specified laws between masses of matter, the question of the mechanism through which they acted being left out of account. Sir Oliver does not believe, however, that this really was Lord Kelvin's position, but that he was constrained, by insuperable difficulties, from elaborating the more philosophical standpoint for the time being. The fact is none the less strange and noteworthy, for it was very largely due to Lord Kelvin's own work that the Clerk Maxwell view of electrical action was able to supersede the purely dynamical conceptions of the great French mathematical physicists.

In Sir Oliver Lodge's opinion, Lord Kelvin's most immortal work was those investigations carried out by him between about 1848 and 1856 in the development and application, to every branch of physics, of the doctrine of the conservation of energy, together with the elaboration of the laws of thermo-dynamics. The keenness and penetration of his mind at that epoch, said Sir Oliver, must have been something astounding. With all his mathematical powers alert, with tremendous natural genius, and extraordinarily vivid interest in phenomena of all kinds, he seized the facts concerning energy, and brooding over the whole domain of physics, elicited therefrom most beautiful and striking discoveries. Nothing since Newton has come up to this achievement. This splendid epoch includes the recognition of the true nature of heat, the discovery of the second law of thermo-dynamics with its corollary law of dissipation or degradation of energy—a law less ultimate and cosmic, in Sir Oliver's opinion, than Lord Kelvin was at times inclined to admit.* The idea of absolute temperature and the realisation of that idea is the famous Thomson-Joule effect.† It includes, moreover, the application of the laws of energy and thermo-dynamics to the flow of a current of electricity through any manner of complex circuit, an application which led to complete and wonderful elucidation of the ideas of self-induction, resistance, capacity, electro-chemical and thermo-electric forces, then but crudely, if at all, understood, and to exact mathematical statements embodying the energy relations between these quantities. Incidentally, the whole theory of transient electric currents (omitting the Maxwellian discoveries of accompanying radiation), or electric oscillations, as we now call them, was beautifully evolved, a theory of fundamental importance to many modern branches of electrical practice, and among the other numerous side issues of this comprehensive work was the suggestion of the idea of a "specific heat of electricity," a mere vague idea at the time put forward hypothetically and hesitatingly, but it was one of those vague ideas which only men of the profoundest insight into physical matters are able even to conceive, and it was an idea which the modern theory of electrons has justified in an unexpected and remarkable degree.

Sir Oliver Lodge has embodied Lord Kelvin's discoveries of these years in the form of the following energy equation, an equation which includes the transformations of electric energy that take place respectively in a resistance, a self-induction, a capacity, an electro-chemical cell, a junction of dissimilar materials (according to Sir Oliver Lodge wrongly identified by Lord Kelvin with the Volta effect), and along an equality of temperature (the so-called Thomson effect):—

$$\mathrm{E}\,\mathrm{C}\,.\,dt = \mathrm{R}\,c^2\,dt + \mathrm{L}\,\mathrm{C}\,.\,d\mathrm{C} + \frac{1}{s}\int_t^{\circ} \mathrm{C}\,.\,dt + \Sigma\,(J,\epsilon\,\theta)\,\mathrm{C}\,.\,dt + \pi\,.\,d\mathrm{Q} + (\sigma_1 - \sigma_2)\,d\mathrm{Q}.$$

An inevitable development arising out of the elucidation of these energy-relations was the conception of the idea of absolute measurement, the realisation of which involving the invention of suitable units and the mode of measuring in such units, particularly in the case of electrical and magnetic quantities, is indissolubly bound up with Lord Kelvin's name. In describing this part of his subject, Sir Oliver Lodge took the opportunity of reminding his hearers that anything constant will do for a unit of absolute measure, and he thought it a great pity that the inventors of the metric system did not employ old historical units—like the yard and pound—instead of brand new ones supposed to be connected with the size of the earth. The real essence of absolute measure is that every quantity must be completely specified, so as to be of the right dimensions without any factor being omitted or assumed. An equation, which is only true when the quantities are interpreted in a certain way, is not really an equation at all, but an arithmetical dodge, "a handy conventional rule available for Englishmen" (if expressed in feet and pounds), but not a fundamental equation, true in every system of units throughout the universe.

Lord Kelvin was nothing if not thorough. Progress in the practical realisation of an absolute system of units was impossible without standard apparatus, so he set himself to design a whole series of beautiful and exact electrical measuring instruments, which have long been indispensable to the physicist and the electrical engineer. On this side of Lord Kelvin's work Sir Oliver Lodge was able to say little, beyond calling attention to the strongly mathematical—rather than experimental—basis on which they were designed. This is particularly the case with the quadrant electrometer and allied electrostatic instruments, which are treated as variable condensers, and hence designed for one flat surface to move over two other flat surfaces.

In the region of modern electrical theory—what is now included under the heading of the electron theory of matter—Lord Kelvin's mind was somewhat conservative, but even here we owe to him some important advances, notably the ideas and calculations contained in his 1901 paper, characteristically styled "Æpinus Atomised." Here, for the first time, were worked out some of the properties of the atom, consisting of a spherical portion of uniform positive electricity in which are scattered negative electrons. Lord Kelvin worked out the conditions of stability for various simple groupings, an investigation which has been extended, and which has yielded such remarkable results at the hands of Prof. J. J. Thomson, so that much of to-day's accepted views regarding the structure of the atom, and the theory underlying the periodic law and radio-active phenomena, is based on this pioneering work of Lord Kelvin. He also calculated, in the same paper, what happens when two simple uni-corpuscular atoms approach one another, a calculation which Prof. J. J. Thomson has extended in order to account for many of the fundamental facts of chemical affinity.

Finally, SIR OLIVER LODGE dealt with Lord Kelvin's pregnant work on celestial dynamics, a subject which had a peculiar fascination for him at all times, as, indeed, it has had for all the giants of physical science, and which formed the subject of a posthumous paper that has now been published. Lord Kelvin here conceived of the beginning of a universe when all the matter in a sphere of radius 3×10^{16} kilometres was spread uniformly throughout the sphere, choosing the particular conditions under which actual stellar velocities could be generated. We need not follow Lord Kelvin through all his wonderful and suggestive calculations; the outstanding fact of supreme interest is, as Sir Oliver Lodge remarks, that at the close of his long life, a life devoted to the profoundest contemplation of all the intricacies of natural philosophy, he was forced to views regarding the atomic origin of all things—and he could never imagine but that the material universe actually did have a beginning or an origin—closely resembling those presented by Democritus, Epicurus, and their majestic Roman poetic expositor, Lucretius.

* We do not, for example, know what the influences of "life" may be in this connection. *Irreversibility means only that things have got temporarily beyond our control.*

† The basis of modern methods of liquefying gases.

The Physical Society.

AT the meeting held on May 22nd, MR. F. P. SEXTON read a paper "On the Spectrum Top," and one "On the Coefficient of Diffusion" was read by MR. B. W. CLACK. MR. B. S. COHEN then read a paper on "The Production of Small Variable-Frequency Alternating Currents suitable for Telephonic and other Measurements." As an introduction a summary of the methods used by the author for such currents is given. A new method for producing these currents is then described; this consists of a form of vibrating wire interrupter which operates a make-and-break contact. This is used to put a source of potential on and off a resonating circuit tuned to any desired frequency. The alternating

current is taken from a small transformer in the resonating circuit. A series of damped wave-trains of any frequency can be produced by this means, the trains following each other with the frequency of the wire vibrations. Several forms of circuit are described, one of which gives a train of oscillations at each break of the supply circuit. Other circuits give damped waves both on the break and on the make contact, and by a suitable combination of two oscillating circuits worked from one mercury cup and contact it is shown that continuous and fairly uniform oscillations can be produced. The theory of action of the various circuits is briefly entered into, and the paper concludes with some applications of the waves produced to both telephonic and general electrical measurements. The wave forms given by the various circuits were shown at the meeting by means of a Duddell oscillograph.

Mr. A. Campbell mentioned that with his vibrating-bar microphone hummer he had found it easy to obtain more than one frequency from the same bar, by altering the supports to suitable nodal points and tuning the magnet circuit with a condenser. Harmonics of the fundamental frequency were thus produced. He asked if any of the composite wave forms shown gave vowel sounds in the telephone.

Dr. Russell said he understood that the author's main object was to obtain currents having frequencies varying between 100 and 5,000 which followed the harmonic law. Some of the methods described, in particular the author's "double action circuit" method, seemed well adapted for this end. In some of these circuits there were two free periods of vibration, and it was exceedingly interesting to see the accuracy with which the oscillograph gave the resultant of two slightly damped trains of high-frequency waves of different periods. Tuning for resonance, the author obtained a very perfect sine wave.

Mr. Cohen said that the currents shown, when passed through a telephone receiver, did not produce vowel sounds.

THE CONSTRUCTION OF INCANDESCENCE BODIES.

A lengthy article, entitled "The Electrical Conductivity of Carbides and the Principles underlying the Construction of Metallic Filaments for Incandescent Electric Lamps," recently appeared in the *Chemiker Zeitung* from the pen of Dr. C. R. Böhm. After discussing, with a considerable amount of detail, the properties of the different carbides worthy of mention, and the different processes employed by inventors to produce a compound filament, and to form it ready for use, as well as recording numerous experiments of his own, Dr. Böhm summarises the results of his investigations in a manner that may be further condensed as follows:—

The high light-emissive power of the alkaline earths and magnesia was known long before the electric arc was introduced into trade, and therefore attempts were soon made to employ those substances in electric light sources, a certain measure of success being quickly obtained. When, however, Welsbach's investigations into the properties of the rare earths were published, attention was properly concentrated on the latter. The improved electrical incandescence bodies constructed from them are mixtures composed of one or more representatives of each of two classes of substances. The first class of substances comprises good electrical conductors, such as carbon or a metal; the second-class comprises light-emissive bodies such as oxides, which also conduct the current. Originally oxides or salts were mixed with carbon, made into a paste with gum arabic, treacle, or tar, and expressed into the shape of threads; or vegetable fibre or a thread of collodion was impregnated with a suitable salt solution. A second plan was to coat a core of carbon with a material of either the first class (a metal) or the second class (an oxide). The third plan was to construct the core of a metal, using one of the refractory metals of the platinum group. The most refractory metal, osmium, was too brittle, and could not be employed until Welsbach had shown how the difficulty might be overcome. The methods just described have not proved satisfactory, owing to the chemical decomposition which occurs at the extremely high temperature prevailing during the passage of the current, carbides being formed, gas being evolved, and the filament being disintegrated. Moreover, when a filament is formed of a carbon or metallic core, the superficial area of the outer coating is five or six times that of the centre; and in order to establish incandescence so much energy must be expended that the core volatilises. If mixtures of two or more oxides are used, as in the Nernst glower, the troublesome preliminary heating arrangement now adopted cannot be dispensed with.

In Bolton's method, the lower oxide of tantalum, which is a conductor, is mixed with the dielectric oxide of zirconium (ZrO_2), and the whole is formed into a filament, and heated in a suitable receptacle in an electric furnace. The tantalum is thereby reduced to the metallic state, while the zirconium oxide remains as such, but is brought to the finest possible state of sub-division. The latter is a most desirable state of affairs, and cannot easily be attained by mechanical means. The defect in the Bolton process is the great affinity for water possessed by metallic tantalum. On substituting tungsten (wolfram) for it, the trouble disappears, and the latter can be reduced in a current of hydrogen in contact with conductors of the second class in such conditions that the latter are most intimately mingled with the metal. An improvement consists in fusing molecular mixtures of ThO_2 and ZrO_2 with tungstic acid in an iridium crucible with the aid of an oxy-hydrogen blowpipe. The melt is powdered and heated in hydrogen, and contains conductors of the two classes in the maximum condition of sub-division. If incandescence bodies can be successfully prepared in this way, containing only a metal and an oxide—and the most recent patents appear to point in that direction—a material will be obtained which may be said to combine in itself the functions of the glower and of the preliminary heater in the Nernst lamp. As materials of the kind can hardly be made without the use of some agglutinant of an organic nature, the finished products should apparently contain some carbides. It may be remembered that in 1899 Somzée, of Brussels, proposed making a filament out of elemental silicon with small additions of rare earth oxides in order to render the whole more emissive.

The benefit derived from adding to the carbons for arc lamps, some salt of an alkaline earth or rare earth metal or of magnesium, has been known for long. The best results are obtained with calcium salts, as barium, aluminium, and magnesium compounds are less efficient in the matter of light emission, while strontium salts render the light too red. The commonest substance to introduce is fluorspar, but it yields an orange light which tends to red if the voltage of the current falls or the carbons are thick. There is no doubt that carbides are temporarily formed in all these chemical carbons, being immediately dissociated by the heat of the arc and converted into oxides. It is recognised that the conductivity of the vapours of the alkaline and rare earths is good; and that a steady light does not depend upon the molecular proportions of the ingredients in a carbon alone, but is also affected by its shape and other conditions. Keyser has attempted to avoid the formation of slag by using ready-made carbides in his arc carbons, incorporating with the carbon itself an alkaline earth carbide and surrounding the whole with a layer of copper to protect the carbide from the decomposing action of the atmosphere. Gerard and Fiedler have recently proposed using a material obtained by igniting a double nitrate of lanthanum with thorium or zirconium, which is claimed to yield a carbon affording three times as much light as ordinary carbons, and to form an arc only 1·5 mm. in size instead of the customary 3 to 6 mm. The facts as to size and light emission may well be as the inventors represent, but their notion that complicated nitrates are first formed, to be afterwards converted into compound peroxides which give the arc special properties, cannot be admitted to be correct.

Power Tests of a Motor-Driven Geared-Head Lathe.—The following tests made on a Lodge & Shipley 24 in. × 10 ft. standard engine lathe will be of interest. The lathe was directly connected to a 220-volt 10-H.P. motor running at 450 to 900 revs. per min., and the material on which the tests were made was machinery steel, having about 0·3 per cent. carbon. It should be mentioned that only short runs were made, in order to do away with the use of the steady or follow rest, which consumes a considerable amount of power. This, of course, must be allowed for in the motor. With the exception of No. 5, all the cuts were driven through the 4 to 1 back gear. In order to obtain the weight of metal cut per minute, the factor 0·28 lb. per cubic inch may be used.

Power Tests of a Motor-Driven Geared-Head Lathe.

No. of test.	Speed.		Feed, inches.		Cut, inches.			Carriage travel per min. in inches.	Cubic inches of metal per minute.	Weight of bar after cut, in lb.	Horse-power.	
	Idle.	Cutting.	Calculated.	Actual.	Diameter before cut.	Diameter after cut.	Depth of cut.				Idle.	Cutting.
1	90	90	1/8	1/8	4 1/8	4	1/16	8·0	17·35	291	0·90	13·2
2	90	90	1/8	1/8	4 1/8	4 1/16	1/32	8·7	25·0	4·0	0·90	17·7
3	60	60	1/8	1/8	4 1/8	4 1/16	1/32	8·0	28·8	484	0·90	20·9
4	100	90	1/8	1/8	4 1/8	3 15/16	1/16	16·3	30·3	510	0·90	20·0
5	135	135	1/8	1/8	4 1/8	3 15/16	1/16	3·0	9·49	160	1·48	8·8
6	110	100	1/8	1/8	8 1/2	8	1/4	16·7	27·0	454	0·90	20·6

Water and Blast-Furnace Power.—The Metz Chamber of Commerce has forwarded a petition to the General Administration of the Imperial Railways at Strasburg in reference to the question of the introduction of electric traction on the railways in Alsace-Lorraine, and advocating the adoption of motor coaches on the branch lines. It is pointed out that this system would be very suitable for the conditions in these provinces, as the branches from the main lines are more numerous than is the case with most of the other railway networks. About two-thirds of the 22 branch lines serve the valleys of the Vosges with their highly developed textile, timber and stoneware industries in Upper and Lower Alsace, whilst the remainder open up the valleys of Lorraine with their mining and metallurgical industries. It is considered that the existing steam method of locomotion no longer meets the requirements of the country, but that electrical working by means of motor coaches or by accumulator cars would fully answer the purpose. The petition also submits that the conditions for the production of cheap electrical power are extraordinarily favourable, inasmuch as water-power could be utilised in Alsace, whilst the blast furnaces in Lorraine would likewise yield power by drawing upon the waste furnace gases. The subject is to be considered at the next meeting of the Imperial Railway Committee for Alsace-Lorraine.

IMPORTS OF ELECTRICAL GOODS INTO EGYPT IN 1907.

The following figures, showing the imports of electrical and other materials into Egypt during the years 1906 and 1907, are taken from the official trade statistics for 1907 recently issued; figures showing increases and decreases during 1907, as compared with 1906, have been added.

	1906. £E.	1907. £E.	Increase or decrease. £E.
Copper manufactured or in Sheets.—			
From United Kingdom ...	170,584	191,426	+ 20,842
„ Germany	14,310	12,593	— 1,717
„ France	53,785	52,220	— 1,565
„ Italy	4,532	7,178	+ 2,646
„ Other countries ...	9,043	7,347	— 1,696
Total	252,254	270,764	+ 18,510
Steam Engines fixed or half fixed, including boilers, &c.—			
From United Kingdom ...	230,263	174,001	— 56,262
„ Germany	20,902	23,611	+ 2,709
„ France	35,039	10,951	— 24,088
„ Italy	24,041	7,124	— 16,917
„ Switzerland ...	23,162	45,084	+ 21,922
„ Other countries ...	19,244	5,567	— 13,677
Total	352,651	266,338	— 86,313
Electrical Machines.—			
From United Kingdom ...	35,469	42,441	+ 6,972
„ Germany	11,718	7,537	— 4,181
„ United States ...	1,889	3,018	+ 1,129
„ Austria-Hungary ...	6,907	12,196	+ 5,289
„ Belgium	6,267	5,557	— 710
„ France	27,652	11,312	— 16,340
„ Italy	17,959	11,686	— 6,273
„ Sweden	9,136	14,862	+ 5,726
„ Other countries ...	107	205	+ 98
Total	117,104	108,814	— 8,290
Carriages and parts, for Railways, Tramways, &c.—			
From United Kingdom ...	110,118	96,408	— 13,710
„ Belgium	163,163	85,190	— 77,973
„ Other countries ...	1,945	254	— 1,691
Total	275,226	181,852	— 93,374
Lamps of all kinds, and parts thereof.—			
From United Kingdom ...	5,805	7,893	+ 2,088
„ Germany	15,540	20,324	+ 4,784
„ Austria-Hungary ...	22,196	28,954	+ 6,758
„ France	14,718	18,079	+ 3,361
„ Sweden	4,136	8,486	+ 4,350
„ Other countries ...	3,528	3,895	+ 367
Total	65,923	87,631	+ 21,708
Electrical, Telephone and Telegraph Apparatus.—			
From United Kingdom ...	61,120	70,187	+ 9,067
„ Germany	31,583	26,010	— 5,573
„ United States ...	1,336	2,788	+ 1,452
„ Austria-Hungary ...	21,823	12,126	— 9,697
„ Belgium	6,600	9,532	+ 2,932
„ France	39,300	54,851	+ 15,551
„ Italy	5,932	14,607	+ 8,675
„ Sweden	552	—	— 552
„ Switzerland ...	3,000	1,849	— 1,151
„ Spain	11	—	— 11
Total	171,257	191,950	+ 20,693

Note.—£E = £1 0s. 6½d.

NEW PATENTS APPLIED FOR, 1908.

Compiled expressly for this journal by W. P. Thompson & Co., Electrical Patent Agents, 322, High Holborn, London, W.C., and at Liverpool and Bradford, to whom all inquiries should be addressed.

11,298. "Improvements relating to mercury interrupters for alternating electric currents." F. W. W. Baker and A. C. Gunstone. May 25th.

11,299. "Improvements in or relating to the measurement of intensity and tension of electric currents delivered by an induction coil." F. Klingelfuss. May 25th. (Complete.)

11,336. "Improvements in connection with dynamo-electrical machinery, subject to fluctuation of load." The Electric Construction Co., Ltd., and W. Buchanan. May 26th.

11,339. "Improved method of firing mines and the like by electricity." J. Pichler. May 25th.

11,344. "Improvements in and relating to electrical power transmission system." British Thomson-Houston Co., Ltd., and W. F. Dawson. May 25th.

11,345. "Improvements in and relating to the control of electric circuits and apparatus." British Thomson-Houston Co., Ltd. (General Electric Co., United States.) May 25th.

11,346. "Improvements in insulators for overhead systems of electric railways and the like." F. Guillot. (Date applied for under Sec. 91 of the Act, October 10th, 1907, being date of application in United States.) May 25th. (Complete.)

11,347. "Improvements in and or connected with conductor rails for electric railways and the like." C. H. Merz and S. G. Redman. May 25th.

11,394. "Improvements relating to electrical-relay applications." A. Orling. May 26th.

11,404. "Improvements in protective devices for electric circuits." K. Edgcumbe and E. I. Everitt. May 26th.

11,432. "Improved magneto-electric ignition apparatus." G. A. Unterberg and F. Helmle, trading as Unterberg & Helmle. (Date applied for under Sec. 91 of the Act, December 6th, 1907, being date of application in Germany.) May 26th. (Complete.)

11,446. "Method of and means for transmitting pictures and the like from a distance." F. De-Bernochi. (Date applied for under Sec. 91 of the Act, March 31st, 1908, being date of application in Germany.) May 26th. (Complete.)

11,460. "Improvements in and relating to incandescent electric lamps." British Thomson-Houston Co., Ltd., and T. E. Robertson. May 26th.

11,471. "Improved means for adjusting points of sparking plugs for motor engines." H. S. Cooke. May 27th.

11,511. "Improvements in electrical contacts." Siemens Bros. & Co., Ltd. (Siemens & Halske Akt.-Ges., Germany.) May 27th. (Complete.)

11,512. "Improvements in or relating to switch arrangements for starting electric motors." Siemens Bros. Dynamo Works, Ltd., B. G. Payne and E. Schupp. May 27th. (Complete.)

11,517. "Improvements in continuous current machines." Siemens-Schuckert Werke G.m b.H. (Date applied for under Sec. 91 of the Act, July 27th, 1907, being date of application in Germany.) May 27th. (Complete.)

11,594. "Improved manufacture of metal incandescence filaments free from carbon." Siemens & Halske Akt.-Ges. (Date applied for under Sec. 91 of the Act, June 8th, 1907, being date of application in Germany.) May 27th. (Complete.)

11,529. "Improvements in apparatus for treating the body with rays of light and heat. M. C. A. C. Kroeger. May 27th. (Complete.)

11,554. "Improvements in high-tension distributors for electric ignition in internal combustion motors." G. Jack and E. F. Robertson. May 28th.

11,558. "Improved method of and apparatus for compounding alternating current generators." J. E. L. Barnes. (M. Breslauer, Germany.) May 28th.

11,564. "Carbon steadier for arc lamps." E. Cunningham, jun. May 28th.

11,575. "Trolley drip protector." S. B. E. Ward. May 28th.

11,584. "Improvements in or relating to apparatus for electrically igniting miners' safety lamps in mines." A. E. Best, R. O. Best and M. Best. May 28th.

11,592. "Improvements in dynamo-electric generators and motors." E. B. Gray. May 28th.

11,595. "Improvement in magnetic clutches." B. M. Drake and R. W. Smith. May 28th.

11,596. "Improvement in magnetic clutches." B. M. Drake and R. W. Smith. May 28th.

11,599. "Process of producing filaments for electric incandescent lamps of vegetable oils and resins." K. Rittersberg and H. Rubert. (Date applied for under Sec. 91 of the Act, September 6th, 1907, being date of application in Germany.) May 28th. (Complete.)

11,600. "Process of producing filaments of Chinese ink for electric incandescent lamps." K. Rittersberg and H. Rupert. (Date applied for under Sec. 91 of the Act, October 30th, 1907, being date of application in Germany.) May 28th. (Complete.)

11,603. "Improved manufacture of tungsten incandescence filaments." Siemens & Halske Akt.-Ges. (Date applied for under Sec. 91 of the Act, June 8th, 1907, being date of application in Germany. Application for Patent of addition to No. 18,489/07.) May 28th. (Complete.)

11,607. "Illuminating canopy electrically lighted underneath for billiard and operating tables and the like." E. R. Crook. May 28th.

11,608. "Improvements in and connected with trolley wheels for electric tramway and like purposes." V. G. Lironi. May 28th.

11,610. "Improvements in connections for electric batteries." May 28th. The New Ignition Syndicate, Ltd., F. J. Rouse and W. J. L. Sandy. May 28th.

11,633. "Improvements in and relating to alternating current dynamo-electric machines of the commutator type." Allgemeine Elektricitats-Ges. (Date applied for under Sec. 91 of the Act, May 29th, 1907, being date of application in Germany.) May 29th. (Complete.)

11,634. "Improvements in and relating to electric distributing systems." The British Thomson-Houston Co., Ltd., and E. B. Wedmore. May 28th.

11,650. "New and improved dynamo to give a constant output when driven from a varying speed source." R. C. Black. May 29th.

11,758. "Improvements in or relating to the electric lighting of roundabouts and the like." H. M. Darrak and L. A. Hackett. May 30th.

11,806. "Improved alternating current electro-magnet." D. L. Lindquist. May 30th. (Complete.)

11,814. "Electro-automatic sounding apparatus." C. F. Varela. Application for patent of addition to No. 5,444/08.) May 30th.

PUBLISHED SPECIFICATIONS.

Copies of any of these Specifications may be obtained of Messrs. W. P. Thompson & Co., 322, High Holborn, W.C., and at Liverpool and Bradford; price, post free, 9d. (in stamps).

1907.

Electrical Block Signalling System for Railways. G. H. Brown. 10,087. May 8th.

Means for Connecting Up Electric Cables. R. Brown. 10,948. May 10th.

Repulsion Electric Motors. Felten & Guilleaume Lahmeyerwerke Akt.-Ges. 10,969. May 10th. (Date applied for under International Convention, May 14th, 1906.)

Dynamos for Train Lighting. H. Leitner. 11,086. May 11th.

Telephone Receivers. H. W. Sullivan. 11,086. May 13th.

Sockets for Electrical Purposes. E. Lawley-Pinching and W. H. Walton. 12,462. May 29th.

Control of the Supply of Electrical Energy to Consumers. J. S. Highfield. 13,543. June 11th.

Manufacture of Refractory Electrical Conductors Suitable for Electric Lamps, Furnaces and the like. British Thomson-Houston Co. (General Electric Co., United States.) 15,451. July 4th.

Laminated Core Structures, Particularly Applicable to Dynamo-Electric Machines. British Thomson-Houston Co. (General Electric Co., United States.) 18,211. August 12th.